AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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New Tubulous Steam Boiler.

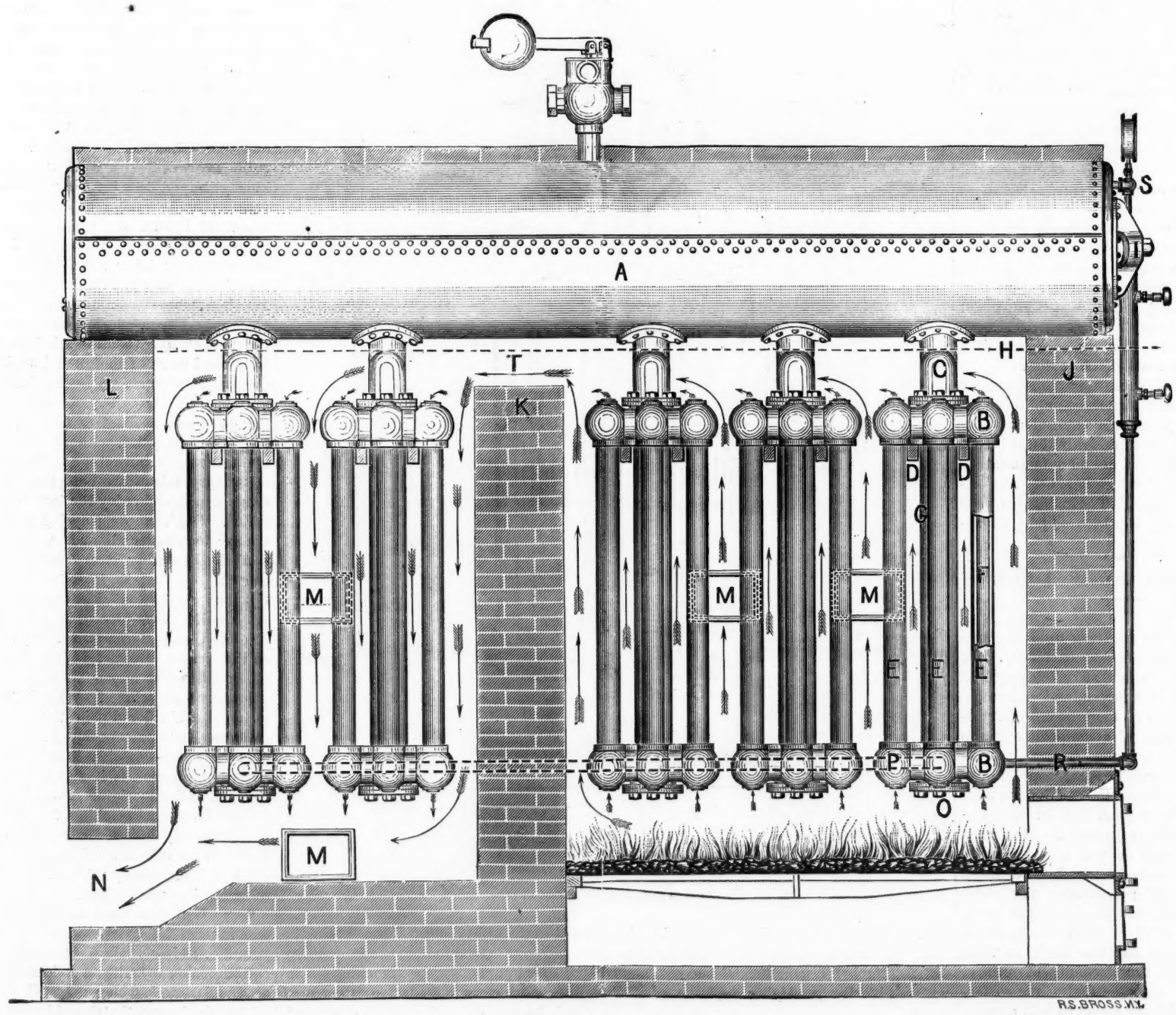
In this age of improvement, when almost everything for which there is any considerable demand is manufactured, or effected by steam, it becomes, therefore, necessary to generate the steam required for these operations in the most economical way.

The demand for a good steam generator has, for the foregoing reasons, become necessarily large, and has set the inventive genius of the inventors at work to produce a steam boiler that shall arrive at the nearest approximation to perfection.

The result has been, that the number of different patterns of boilers now in existence is growing, and all of them have more or less good features. Our attention has lately been directed to a new tubulous steam boiler, which, by the aid of the accompanying illustrations, we will describe.

Referring to the illustration, A represents a steam drum, which is made of the best brand of iron, 24″ in diameter, and $\frac{5}{16}$″ in thickness, while the length is governed by the number of sections of tubes required to be attached to it. This drum has two double riveted longitudinal seams on the sides where they are not exposed to the fire. The heads are made of wrought iron, well stayed. A man-hole, I, is placed in one end by means of which all the parts are easily accessible. The sections, C, are attached by means of well riveted joints to the bottom of the drum, A. The different sections are made after the following manner: B B represents malleable iron or steel spherical-shaped sections, or connecting spheres, which are attached to each other by wrought iron tubes, E E E, 3″ in diameter, fitted into holes bored to fit the tube which is then inserted, and then expanded with a suitable tool, thereby making a thoroughly tight and secure joint.

Within each of the 3″ tubes are placed others, shown at F, of the same material, 1½″ in diameter, and fitted and expanded in the same manner, but with this difference: the 3″ tubes are attached to the side of the spheres, while the 1½″ tubes pass directly through and are fitted to the opposite side. By this arrangement it will be understood that the water is contained between the outside and inside tubes, while the 1½″ tubes are open at the ends. The heat passing inside the 1½″ tubes, and outside of the 3″ tubes, greatly increases the heating surface. Thus it is claimed by the inventors to generate steam rapidly, and with the smallest amount of fuel. In the center of all these tubes is placed a large tube, G, of 5″ diameter, which contains water, and, in practice, the water rises in all the 3″ tubes and descends through the 5″ center tube, thus insuring a good circulation, which is a very essential point in steam boilers. The bottom of each section is provided with an opening, which is covered by the plate O. By removing these plates, the bottom of each section can be readily washed and inspected. The flanges to which these plates are attached, also those on top of the sections, are drilled to the same template, thereby allowing the sections to be reversed when the lower part becomes corroded or wasted by the action of the fire. Each of the joints on the sections are faced and put together with asbestos packing, upon which the fire has no effect. Two bars of square iron, represented by D D, are placed across through each section, thereby making it possible to remove any section for inspection or repairs, without disturbing any of the others. The bottom of each section is connected with the pipe shown by the dotted line P, which is of sufficient capacity to insure a uniform water level, which is represented by the dotted line H. The pipes R and S, to which the water gauge is attached, are large, and, as represented, are connected with the lowest and highest points in the boiler, thereby avoiding the difficulties which appear with some other arrangements. M M represent openings through the walls, by means of which each of the sections can be readily cleaned and inspected. The hot air and gases rise from the fire between the wall J, and bridge wall K, and coming in contact with the steam drum pass along through the opening T, into the combustion chamber between the walls K and L, where, in their downward course the gases and smoke are claimed to be nearly, if not perfectly, consumed. The passage N leads to the chimney. There should always be a damper in this



New Tubulous Steam Boiler.

passage so as to retain the heat, to insure the most perfect economy, as great losses occur continually by allowing the heat to pass off at too high a temperature. The water may be carried as high as may be desired, but it is thought best to carry it as represented in the cut, and take the steam from the center of the steam drum so as to draw on all parts of the boiler equally. We have found evidence where these boilers have been run completely dry and cold water then put in and no explosions occurred.

It is beyond dispute, that this pattern is made in the strongest possible manner, and the leaking caused by the unequal expansion of the different parts (as in some other boilers), is entirely overcome, as all the parts are equally subjected to the heat. The design is plain, and easily understood.

The inventors claim by the general arrangement of this boiler to furnish dry steam, and avoid priming or foaming.

It is also very compact, occupying but little floor space, and can be easily taken apart by any one that can use a monkey wrench, and packed for transportation, as two sections can be carried on the back of a mule, which is very desirable in mining countries; and when ready to set up, nothing is required in the shape of tools except a monkey wrench, as none of the tubes are removed, therefore a large amonnt of time and skill are dispensed with. No deposit of dirt can take place in the tubss to stop them, as they are all vertical. The boilers which we have seen give evidence of care in the manufacturre, and the drums or any of the parts can be made of steel when required.

The manner of hanging the boiler upon square bars effectually overcomes the danger of any strains to any part, from unequal expansion. As a whole, when properly set it has a neat and tasty appearance. The boiler is furnished at a very low cost.

Patents are now pending to secure still further improvements in the boiler.

An expert test is soon to be made, and we will doubtless soon be able to publish something in the shape of definite results

These boilers are thoroughly tested before leaving the works, and are manufactured by the Pond & Bradford Boiler Co., 34 Cortlandt st., New York, E. T. Bradford, manager, to whom all inquiries should be addressed.

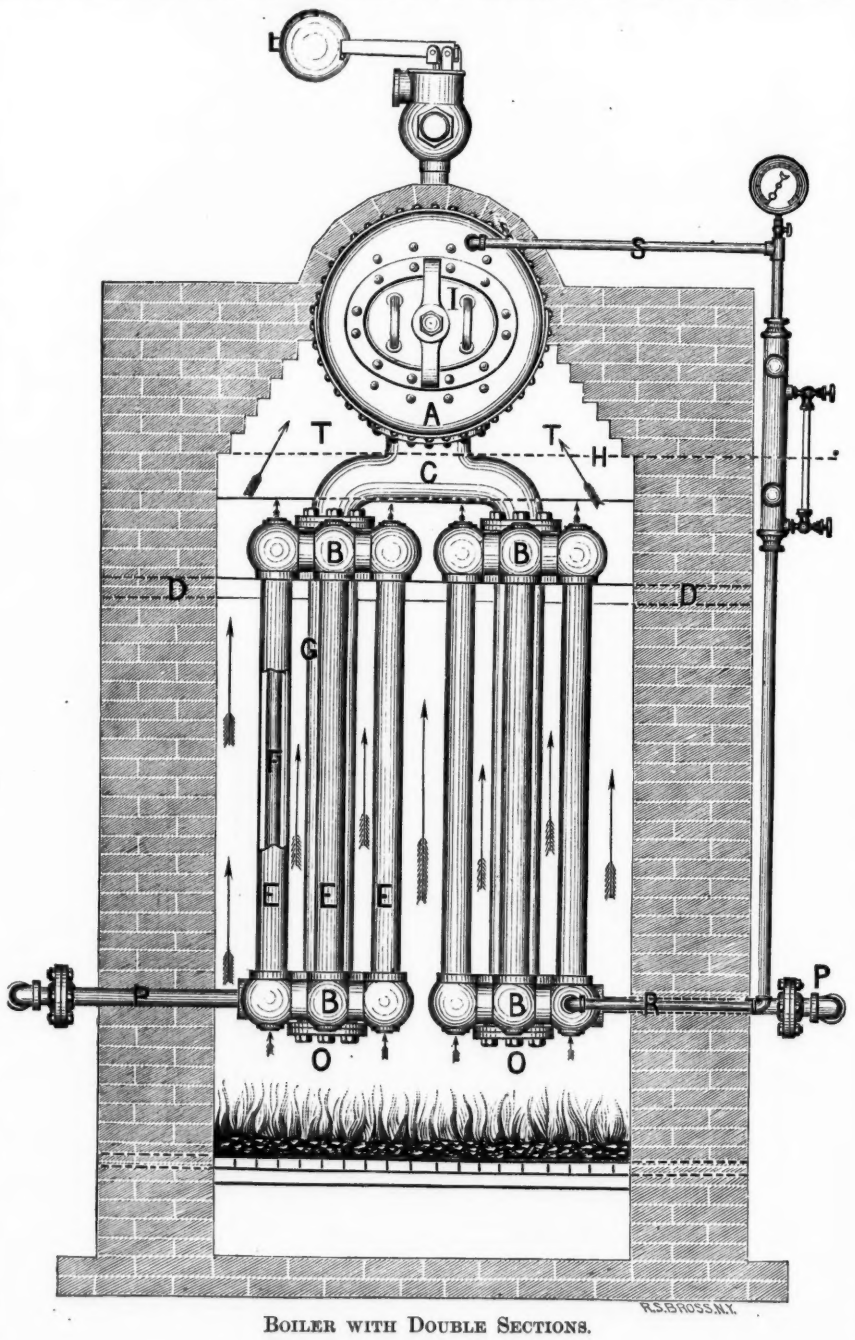
Extracts from Chordal's Letters.

Mr. Editor:

* * * * I am studying up on the subject of paint, as it relates to machinery. We can all remember when all machinery had to be painted a grass green, and decorated, maybe, with stripes of more or less contrasting hues. The age of green paint was also the age of ornate curves and general elaborate design. Certain prominent machine builders commenced designing their machines on what I call the functional plan, that is: each element was treated as regarded its duty only; the form was such as was dictated by its functions only; lines of strength were placed in the lines of strain; and under no circumstances was a pleasing shape sought after, save such as resulted from an apparent adaptation of parts to their work, or what might be termed the harmony of utility. Utilitarianism in machine design ran so far, that simple machinery began to look complicated. Instead of soft blending lines, rigid protuberances became the order of the day, a thickness of metal having been determined upon, this thickness was maintained, and the exterior of a casting presented every little projection and complicated sinuosity, which characterized the interior. Bosses were sharply developed, flanges stood out severely, and reinforcements were placed in plain view. The Whitworth machines are a fair sample of this class. American builders have followed, as far as they dared, but none would carry the idea out entirely. Philadelphia builders would design an engine lathe with every important part shaped to meet the essential requirements of function; they would abuse the privilege they had of making a thing ugly, but when they came to the legs of the lathe, they attempted to gather in the very sunlight of lighthearted beauty in design. A cultivated pedal taste is not to be violated even by a Philadelphian follower of Whitworth. Such designers left off all attempts at exterior neatness, because it was not essential to utility, and they left the striping off of the green paint for the same reason.

Then came that happy thought, steel-colored paint, so called, because it had the color of raw steel. This color, on account of its light shade, developed shadows in all details, and brought every line into plain view. It unearthed errors in the surface of castings, and developed a higher grade of foundry skill, and, coincidently, brought to our notice the value of "filler."

Machines designed upon the functional plan meet the approval of all cultivated mechanics, men who have a discriminating judgment, and are capable of appreciating the rare beauties of purely functional adaptation. The machine builder who seeks his customers among such men will find peculiar satisfaction in his commercial success, and will receive the gratifying applause of his peers.



Boiler with Double Sections.

The thoughtless have been led to think that this severe and rigid construction is essentially cheap, because it looks cheap. The fact is that machinery designed on this plan is essentially expensive, and can never, under any conditions, compete in price with machines equally well constructed, but designed on the old composite plan.

The thoughtless adopt the functional plan, and design their machines accordingly; they leave off the painted stripes; they leave off the features they have been using solely for looks; they leave off the green paint, and attempt to get steel color, but find it has degenerated into a hideous colorless blue; they send these machines among an uncultivated class of patrons and —— lose their trade.

The average machine purchaser of the day is not a discriminating mechanic. He simply has need of a certain machine. He applies to Brown by letter and places his order, for a steam pump, perhaps. Brown used to finish his work nicely and well, and used to paint neatly and tastily. But he has got the fever, and gone into the function business without thinking who his customers are. He leaves off his nice finish, because he says it does not add to the utility of his steam pump. He leaves off his tasty painting, because it does not add to the utility of his steam pump. He leaves off the modulating lines, which, in having the same strength, involved a little more metal, because they did not add to the utility of his steam pump. I don't understand why the deuce he don't leave off the fraudulent steel-colored paint, and let it go unpainted, for paint does not add a particle to the utility of his steam pump. The surfaces will rust and look bad, but the surfaces are not moving surfaces, and good looks will not add to the utility, etc. But one thing he soon finds out. Good looks add to the utility of the steam pump *business*. Machine buyers are not foolish enough to "think the less of a jewel, because the casket which contains it is a beautiful one;" in fact, by the direction of their purchases, they show that they are foolish enough to prefer the beauty of appearance, even at some sacrifice of utility. Now Brown, as a builder of steam pumps, knows that it is a ticklish business. He knows that each steam pump builder retains his customers by a very delicate tenure, and that they are prone to run after strange gods. He sends his ugly functional steam pump to Smith, the purchaser. Smith is no cultivated mechanic, and knows nothing of pumps, steam or otherwise, but he knows a nice machine when he sees it, as every body does, you know, and when this pump reaches him he don't see one. He is not favorably impressed. The pump *may* do. That is the highest compliment he can pay it. Virtue in machinery, to be apparent to Smith, must be upon the outer surface. If this steam pump wins its way to Smith's favor, it must be a good one, indeed, for it works against prejudice. If Smith had received an elegant machine, something made to *please* as well as to *do*, he would on its arrival unhesitatingly have taken the thing to his bosom, and have said to friends: This is a *good* machine. In that case, the pump must be a poor one, indeed, to fail, for it has a friend by its side, one who has committed himself in its favor, and who will not eat his words, if he can make them come true.

As a user, I would prefer machines designed on the functional plan. As a spectator, I would prefer to see them; as a builder, I would prefer to build them; as a seller, I would prefer to sell them. But as an owner of machines for others' use, I would prefer beauty enough to guard against neglect; as a seller whose business must leave out sentiment, I would have to sell machines, which would help place themselves in the good graces of the average uncultivated buyer. Questions: Does a beauty of appearance, produced by what the world knows as paint, necessarily destroy or detract from the functional utility of a machine? Does the first impression which a purchaser forms of a machine add to or detract from the future opinion of the machine? Is the average machine buyer a cultivated mechanic, who can see merit, even through steel-colored paint, or is he a man who has the terms "nice" and "good" mixed in his mind? Because I paint my work with a view to please the average buyer, does it follow that the workmanship or the design of forms is less correct? If I turn out machines known by myself to be correct, how many long years of missionary labor must be expended in bringing my customers to that view of things? Won't a little exterior ornamentation help to place my really meritorious machines? Is not the paint cheaper than the missionary labor? If the real merit of design and workmanship goes with the paint, am I not doing as correct a thing, as if I left the paint off? If I leave the paint off, and act as missionary, don't those who do paint, with or without merit under the paint, outsell me? And when my missionary labors are completed don't my rivals step in and enjoy the fruits without the labor? Don't proper painting tend to cause the eye to wander all over a machine, and don't dead painting, steel color for instance, cause the eye to take in details separately? For that reason, don't I need to put a higher finish on details? Does this higher finish on details add any more to the utility than paint on the general surface? Isn't this extra finish of details more expensive than the extra painting of the whole? What is the special virtue of steel-colored paint? Is steel-colored paint any longer steel-colored? Because one man has a well-established trade among cultivated mechanics, is it any reason why I, who sell to the aborigines, should build steel-colored functional machines? My machinery being properly designed and constructed, and made for an uncultivated market, should I paint such machinery with a view to a pleasing effect in such market?

* * * * The most sensible thing I have seen in print lately is John Utter's letter, in your No. 18 issue. He wants some good gear pattern maker to write an article and tell *how he does his work*. You may tell Mr. Utter, without hesitancy, that the said pattern maker won't do it; that said pattern maker could do it, but would prime for the occasion, and assume the style of the professor, thus destroying the virtue of his work. Now why don't you go for Mr. Utter? His letter shows he is after information, and that he can tell a thing right, if he knows it. He *will* get the desired information some way, and then you should make him unfold himself for the benefit of the pattern makers who read the American Machinist.

When a person has just acquired some new knowledge, he can appreciate the condition of a learner, and can thus, as a teacher, adapt himself to the learner's mental processes. The most efficient teachers are young teachers, who are only one lesson ahead of the scholar. My own opinion is, that in a short time Mr. Utter himself should give to pattern-makers

the very thing he now asks for. He will not find it in print to-day.

* * * * Prof. Youmans, in the *Popular Science Monthly* for July, in speaking of the attempts of the well-posted to impart their knowledge, hits the nail on the head exactly. He says:

"There is a certain class of minds whose efforts to explain things, generally leave them more obscure than they were before.

"In undertaking to represent a question they complicate, rather than simplify it, and, instead of helping the learner to understand a subject, they hinder him. This failure to make things lucid and comprehensible, is due to various causes. Oftenest, it comes from a total neglect of the art of luminous writing, and it is unfortunate that many scientific men are not a little perverse about cultivating this art. *They do not, as a matter of conscience, make any effort to enter into the state of mind of the parties addressed, and their expositions, therefore, often fail from lack of adaptation.* Sometimes a subject familiar to teachers of great capacity, is still too abstruse to be grasped by common minds. Sometimes the expounder does not understand the subject himself; and not unfrequently hypothesis are invented to explain unexplainable things, and which serve only to increase existing difficulties."

* * * * I write you this letter from Cincinnati. The Exposition opens in this city on the 10th of September, and I have brought a car load of my stuff twelve hundred miles to exhibit it. Dickens' "poor man after his patent" didn't have the fun I did, in trying to get space in power hall. When I did get it, I found that, owing to some vast oversight, no provision had been made for getting exhaust steam out of the buildings. Steam pipes and water pipes are brought to the spaces nicely, but exhaust pipes must go into a stove-pipe hole in the wall. The flues start just about where the holes come, and traps must be arranged to get rid of condensation. No matter how carefully pipes are cemented into these holes, they will be bound to give way, and then we will see some fine frescoing on the walls. As I look at the thing, the flues will condense exhaust steam, which will fill up the flue, till it can run back through the pipe it came through.

This Exposition, (of course it is called the "grand,") is going to be a pretty good one, and I may give you a line or so regarding it. I forgot to state that I sold my stuff for cash down, at list prices, to a party who will exhibit it himself, so I won't have to worry about those stove-pipe holes any more. I propose to see the show throughout, however, and only hope I can get on the jury, which is to pass on my machinery.

Heretofore the Cincinnati Expositions have had expert tests of steam and other machinery, but now they propose to save the money. As a consequence, no high class engines are here, except the Brown, which I am under the impression is purchased by the Exposition as the motor of Power Hall. I am informed that the engine awards are to be based on indicator diagrams entirely. This is a queer arrangement, and virtually gives the award for the best card, instead of the best engine, and some engine with a leaky valve will carry off the prize. The New England Thread Companies are here in force with model factories, and there is some dissatisfaction expressed on account of the large space occupied by them, while applicants to the number of nearly a hundred are refused space in which to exhibit machinery designed for general use and sale. There are the same features which attend all these shows. One exhibitor can't get half the hall, so he withdraws entirely, and another can't get as much space as a rival, so he goes too.

Messrs. J. A. Fay & Co., builders of woodworking machinery, have generally made an extensive display in every exposition on record. Now they don't enter, and I presume they will follow the plan of Bement, at Philadelphia, and get up a first-class exposition of their own at their warerooms. Cincinnati has a manufacturing suburb, Hamilton, which stands about as Wilmington does to Philadelphia. The Hamilton concerns have heretofore made quite a splurge in the Cincinnati expositions, but this year they go very lightly.

They say they are too busy and short of stock to make proper display. This speaks well for business. A gentleman in Hartford, Conn., told me last week, that he never was going into any more exhibitions, unless he could make a full showing; that people would judge of the extent of an unknown concern by the extent of its exhibit, and that a small one would always be a discredit. I believe he is right, and I am more than glad I have turned my stove-pipe job over to some one else.

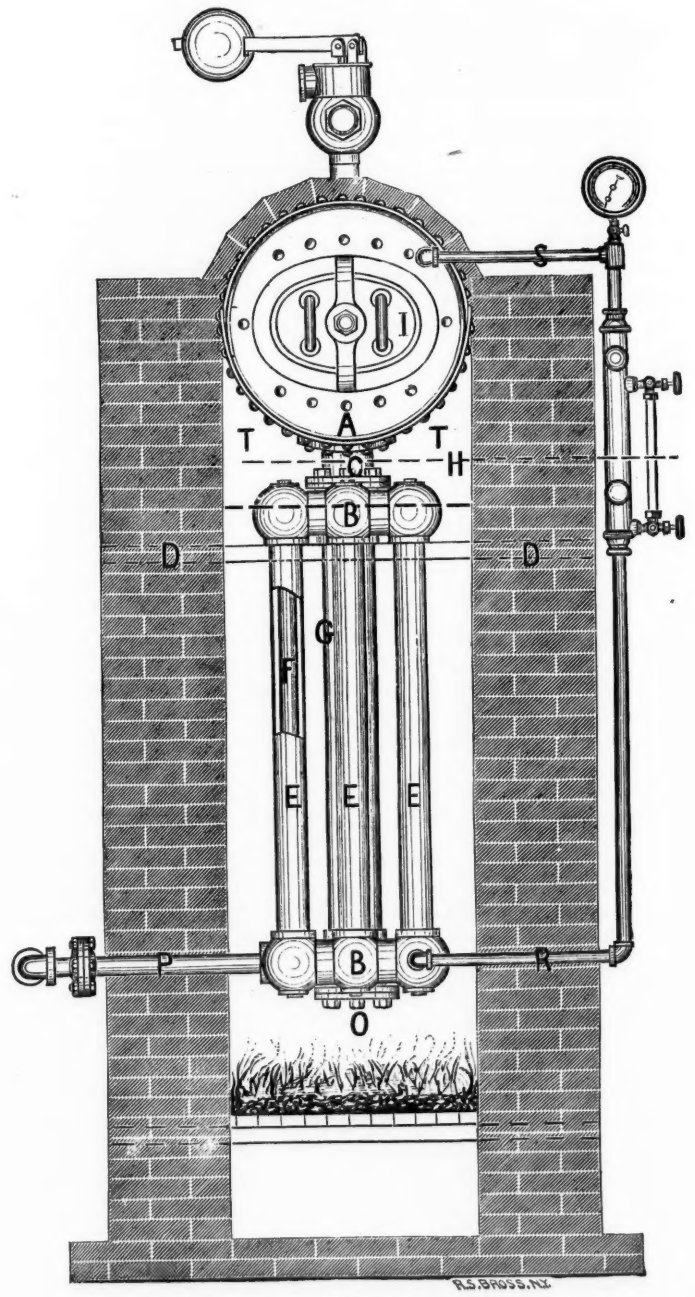
* * * * Very respectfully,

CHORDAL.

Engine Proportion and Construction—Governors and their Speed.

Editor American Machinist:

The steam engine governor has, I believe, received its share of consideration by engineers, especially in this country. To say that our American mechanics have produced an absolutely perfect working instrument in the regulating line, would be putting it rather strongly; but when we claim that we make the best governors for steam engines of all kinds, we have the statement in its true and just form.



BOILER WITH SINGLE SECTIONS.

No English power carpet weaving establishment ever had steady and economical speed until the American model and proportion of regulator was attached to their engines. The English plan generally has been to speed the governor *lower* than the engine. I would like to see them driving carpet looms on this principle. American engineers rarely speed engines in the manner just described, most of them driving the governor at the same speed as the crank shaft. The engines coming to my notice that regulate the best, are those furnished with governors, speeded from 50 to 70 per cent. higher than the engine.

There are many patent *high speed* governors on the fly-ball, spring and water principle, all graded to run from three to six times the speed of crank shaft. But these, whether attached to their own *special* valves or to a detaching valve gear, fail to give the best results where the speed *must* be retained within *one* or *two* per cent. of the standard required.

An engine making 80 revolutions per minute, driving the class of machinery noted above, cannot vary more than one and one half turns per minute without causing a damage to the fabric in weave room. There are engines performing this service to complete satisfaction, but they are not regulated by the extreme high speed governors. As a high speed governor, I believe the "Porter" to be as near perfection as it is possible to attain; it is certainly constructed on scientific principles and is less subject to a trouble I shall speak of further on, than any other regulator of quick motion.

Fixing the weight of the balls at a point that will simply move the latches of cut-off gear readily and freely, and fixing the speed of balls 50 per cent. above engine shaft will, according to my experience, give the best results as to motion.

As the weight of the ball has nothing to do with its *revolving* and *regulating* plane, it is only necessary to have it perform its office as a disengaging mover of the cut-off latch blocks.

Now a quick speeded regulator is so sensitive to *contact* that it is from this cause unfit for steady power. On the same principle that a belt running on a pulley at 2,000 feet per minute is shipped or moved with much greater ease than one at a speed of 500 feet, is the action of the high-speeded governor, the moment it should meet and disconnect the trip catch of cut-off, it receives a shock, falters, and then recoils, changes its own plane, but fails to make the needed *trip* of the catch. At last it settles back and proceeds to try it again. This kind of regulating will not do for weaving, spinning, nor grain grinding, for leaving all other matter out of the case, the speed where large bodies of machinery are in rapid motion must be *steady* and *uniform*, or breakage will result simply from the surging momentum always ready to appear at the slightest call.

Passaic, N. J. WM. H. HOFFMAN,

Activity not Energy.

The *Christian Union* thus defines the difference between activity and energy, and suggests wherein a large class of industrious people lack that element which produces success.

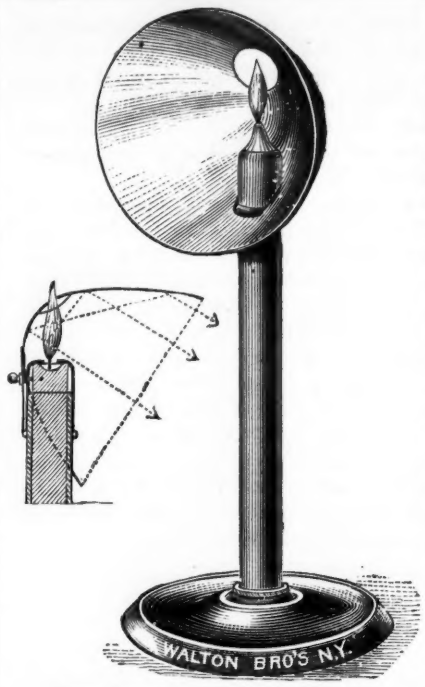
There are some men whose failure to succeed in life is a problem to others, as well as to themselves. They are industrious, prudent and economical; yet, after a long life of striving, old age finds them still poor. They complain of ill luck. They say that fate is always against them. But the fact is, that they miscarry, because they have mistaken mere activity for energy. Confounding two things essentially different, they have supposed that if they were always busy they would be certain to be advancing their fortunes. They have forgotten that misdirected labor is but waste of activity. The person who would succeed is like a marksman firing at a target; if his shots miss the mark, they are a waste of powder. So, in the great game of life, what a man does must be made to count, or might almost as well have been left undone. Everybody knows some one in his circle of friends who, though always active, has this want of energy. The distemper, if we may call it such, exhibits itself in various ways. In some cases, the man has merely an executive capacity when he should have a directive one—in other language, he makes a capital clerk of himself when he ought to do the thinking of the business. In other cases, what is done is not done at the right time or in the right way. Energy, correctly understood, is activity proportioned to the end.

The Poetry of Iron.

There is a wonderful fascination about iron work and iron workers. Novelists have made them the scenes and heroes of their stories; poets have made them the themes of deathless song. We sing of the forge of Tubal Cain, and Hector swore "by the forge that stithied Mars' helm," but the other trades are passed over. When did poet, in lofty numbers, sing of the carpenter lathing a back room on the second floor? Who chants the brawny arms, and the thrilling deeds of a man climbing a four-story ladder with a hod of mortar? Does anybody stand with rapt emotion, and watch a painter putty up a nail hole? I would not exchange my one hour at midnight in the iron works at Ashland, for a whole week watching a man mix mortar with a hoe. Why, these iron works surround the Ashlanders with enough romance to last a Western community at least six weeks. And yet, I suppose there are people about here who never saw a nail made in their lives. I have known times in my own eminently useful and highly ornamental career—times when I was trying to nail a front gate to a leather hinge, when I wished there had never been a nail made anywhere by anybody. And I watched them as they fell from the ponderous machines, fast as rain drops, and it seemed to me, as I watched them fall, that I could hear the dull, treacherous thud of the hammer on the human thumb, the low wail of a woman's anguish, "the big, big D" of a young man in his agony. These strange wierd feelings and fancies rushed into my mind like a torrent. I stooped and picked up a brand new nail, as a memento of my visit. Then I laid it down again. Sadly, but not slowly. I have an impression, I know not where I got it, that a new laid nail, like a new laid egg, is warm. And that it is far more perceptible in the case of the nail. It may not be so in every instance. I presume there may be some nails laid cold. But the one I picked up was not so everlastingly gee-whizzling cold, and I did not investigate any further. —*Burlington Hawkeye.*

New Reflecting Candlestick.

The annexed illustration represents a new candlestick which has been designed to utilize all the rays of light produced by the lighted candle. The upright is composed of a hollow tube, sufficiently large to admit a candle. In the top is an opening for the wick. The candle is pushed up as it burns away, by means of a common wire spring placed under it. A parabolic metallic reflector highly polished, resembling those used in a locomotive headlight, is attached to the top of the tube, and held firmly in place by a spring in the back, as shown in the cut. The object of the reflector is to collect the rays of the candle, and project them upon the paper, or object desired. The light thus collected is said to be nearly ten times as great as that of an uncovered candle placed at the same distance from the work. An adamantine candle numbering seven to the pound, will fit the tube and burn about six hours, at a cost of less than 2½ cts. This candlestick is well adapted to the use of the student, the sick room, the sewing machine, etc., and is also used in the U. S. Navy, to some extent. They seem to meet with a very favorable reception, being entirely new. The light can be projected in any direction, thereby making a shade for the eyes; can also be easily taken apart, and packed in a trunk, occupying but little space. They are manufactured by Joseph J. Walton, No. 19 Dey St., N. Y., to whom all inquiries should be addressed.



NEW REFLECTING CANDLESTICK.

Piston Speed and Steam Compression.

Editor American Machinist:

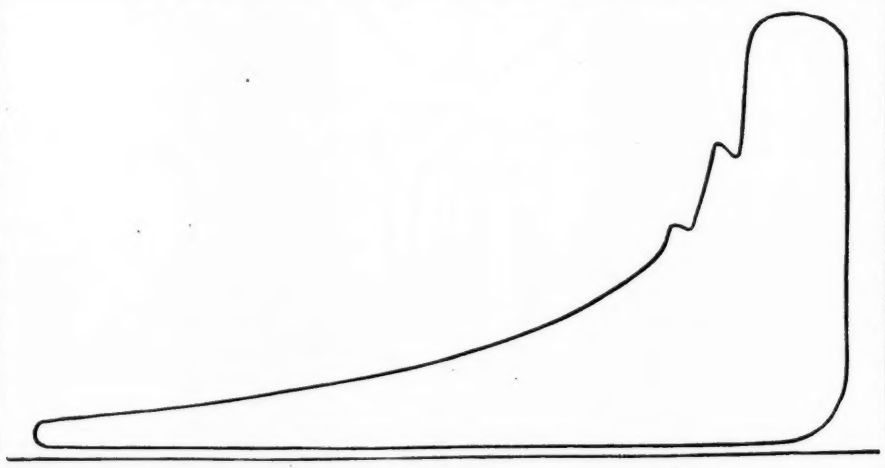
One of the effects resulting from the circulation of your paper will most certainly be a knowledge of the opinions held by your several contributors, in regard to the different subjects discussed from time to time; and if the result of this knowledge shall induce readers to investigate for themselves, and possibly cause them, if they are not too thoroughly "case-hardened" in their views, to throw aside some of their old notions at times, and be satisfied that the world does actually move, the paper may, indeed, take its place as a "popular educator."

In a country as extended as ours, it is no matter of surprise that radically different ideas pertaining to the same subject are indulged in, and a person may be well informed of what takes place in quite an extent of territory, and still be unaware of *everything* that is going on; and, again, it is just simply wonderful what effect "self-interest" will exert in determining as to which end of the telescope of observation we shall look through.

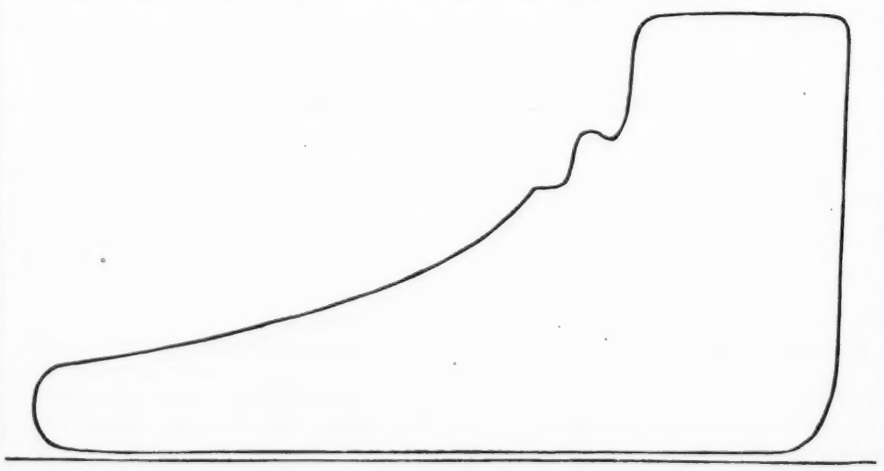
There has been some considerable discussion in regard to "piston speed," and, as it is to be presumed that the race is "free to all," I will unstopper my ink bottle and express a few comments on the subject. I must cordially invite all "the boys" to "exhaust" themselves at me just the minute I run counter to their cherished ideas; whether I am right or wrong does not matter, probably, if somebody's idol is not upset in the conflict.

Mr. Hoffman remarks, that he believes a detaching motion can be devised that will "pass muster" at 100 revolutions per minute; let the gentleman take courage, the thing has been done, and is in successful and constant operation. I am not altogether satisfied about this notion, that rapid revolution is so necessary; it gives, to be sure, in a small and comparatively cheap engine, a high piston speed, but, on the other hand, the proportion of clearance per hour, for a certain power, is greater in the short stroke, and the proportion of surface presented for condensation, as represented by the high terminal pressure generally found on diagrams, from small cylinders exhibits an item that admonishes "temperance in all things." Experience is a great teacher, and, after all the talk about the increased number of opportunities available for regulating purposes, I have seen some of the so-called "best makes" of short stroke engines making from 90 to 125 revolutions per minute, that could not compare with the "long-legged" Corliss machines for steadiness of speed at the balance-wheel rim.

To show that detaching gear can be worked at rapid revolutions, I enclose two diagrams taken from an engine furnished with such gear; revolutions per minute were 90, though 100 could be reached without the slightest difficulty; stroke of engine, 24″, but if such a correct steam line could be maintained in this case, 30″ stroke would scarcely have hurried the piston sufficiently to have caused any damaging effect on the line, even if the very same area of ports were obtained; and what would prevent all the proportions from being increased to the extent that would accommodate a 25″ cylinder with 48″ stroke at the same number of revolutions?



The high terminal pressure which I am afraid some of your correspondents will "go for," if I don't explain, is partly due to the inherent characteristic of small cylinders, this one being 8″ diameter, and mostly to the fact demonstrated by actual test with a calorimeter, that there was present in the steam over 8 per cent. of water, over and above that due to saturation; these diagrams were taken but a short time apart, and their variations were, of course, due to changes in load, engine speed remaining practically invariable.



In regard to momentum of piston, crosshead, etc., some of our engine makers are certainly on the wrong track. One firm I know of advertises—"heavy, stiff framing, and reciprocating parts as light as is consistent with the required strength." Heavy and stiff frame, or bed plate is all right, but to my view, very few builders put sufficient weight in moving parts to *balance* the motion and efforts of the moving masses of metal on one hand, and the "shocking" propensities of the steam on the other.

The compressionists may count me in on their side until further notice. In my experience, those opposing compression broadly either don't know what it is for, or else are engaged in building engines that have little, or no means of "compression adjustment," without placing some other function in a disadvantageous position.

I have a case in mind in which a very prominent engine builder, either would not, or *could not* explain away the necessity of compression, and, indeed, rather gave the impression that he did not know what he was talking about himself, or else considered the party who had his engine in charge, an ignoramus in regard to engines in general, and his (builder's) machine in particular. However that may be, there is no particular call for raising a row at present, for two reasons at least; first, the integrity of said builder was fully manifested when he sent a man at his (builder's) expense, a thousand miles in answer to a complaint that a new engine was fitted up in the shop $\frac{1}{32}$d″ out of line at the crosshead; although the person sent expressed the opinion that the party at this end of the route was "a little too particular" in wanting a new engine any nearer than $\frac{1}{32}$d″ of being in line; second, said engine is now arranged for compression adjustment to any desired extent, and, as the machine is a first-class production of the machinist's art, and will handle a load of 250 H. P. with less fuss than many engines will ½d of that power there is little to be desired especially when the additional fact is considered, that the center line of vertical pressure at the outer pillow block is *now* in the center of the foundation.

And now for fear I have spun this out beyond a conventional extent, I will conclude by mentioning that the engine from which the accompanying diagrams were taken is developing a H. P. on $2\frac{85}{100}$ lbs. of coal per hour, the ashes weighed back (dry) reducing this figure to $2\frac{35}{100}$ths.

And also, I find I have memoranda of another "detaching gear" engine 16″×42″, making ninety-eight revolutions per minute, and "working beautifully;" two more revolutions per minute (and there is nothing in the world to hinder it) would bring the piston speed up to *seven hundred* feet per minute, a tolerably good speed even for positive geared machines; if I can find a diagram from this last mentioned engine I will send it to you at some future time, and, until then,

I am sir, respectfully yours,
CHAS. A. HAGUE.

Chicago, Sept. 9th, 1879.

An English workman thus testifies in the *English Mechanic:* "In very many things our manufactures are not fit to be shown in the same street with American ones; and this is not merely in knick-knacks and little ingenuities, as to which it is tolerably evident we have no pretension to enter into comparison. I only invite any one who doubts my statement to compare such a rough, common matter as 'cut nails.' Our rubbish, with half of them split up, which tends to turn round in the wood and split it, and with conical heads, looks very poor against the straight clean nails, with well-formed heads, which the Americans used to send to Australia, and which, when I had once seen them, prevented me from ever buying an English nail again as long as I could get the American ones."

The following description refers to the process of casting the large equestrian statue of General Thomas in Philadelphia recently:

"In casting the group, it is divided into many different sections, of which there are six large ones and twice as many smaller. As the metal will not average much more than a quarter of an inch in thickness, a huge core of sand is moulded so as to fit inside each section and leave that space between it and the forming mould. After the mould and core have been carefully brought to shape and duly trimmed, they are carefully brushed with a mixture of powdered charcoal and water, and then dried carefully in an oven. This afternoon the largest part of the group—the fore part of the horse's body—was past, and in a few weeks the whole will be put together, burnished, and be ready for erection on its pedestal."

The men of the Bradford, England, iron and machine trades, who have been engaged in an unsuccessful strike for three months, are going over to the number of three hundred to Philadelphia, where they are promised constant employment. A small, selected body of colliers are engaged for New Zealand with free passage, and more are shortly expected to follow; and a Sheffield firm and a full staff of workmen have gone off in a body to the United States.—*London Iron.*

The healthy condition of the iron industry in this country has been brought to the attention of the officials in Washington in a remarkable way. A number of manufacturing firms have declined Government orders on the ground that they have too many private orders ahead to undertake to complete the work offered within the time prescribed. As a general rule, the department is embarrassed in deciding between the numerous bidders, many of whom tie each others bids. In this instance, however, the Government is likely to experience difficulty in getting the proper parties to do the work.

The eleven Bessemer steel works in the United States were represented in the meeting held at the rooms of the American Iron and Steel Association, Philadelphia, for general discussion of production and prices. The reports and other facts presented indicate that the American iron trade is reviving in all directions. It was stated that the number of Bessemer steel ingots manufactured in the United States in 1873 was 170,652, in 1874, 191,933; in 1875, 375,517; in 1876, 525,996; in 1877, 560,587; and in 1878, 732,226. A permanent organization was effected by a meeting of merchant steel makers, and after a prolonged discussion it was unanimously agreed to advance the price of merchant steel.

The Hitchcock Lamps.

These lamps have been attracting considerable attention for the past two years, and a brief description of them may not be uninteresting to our readers. The railroad car and ship lamp burns lard oil, which the manufacturers claim ensures perfect safety, without chimney or globe, and gives a large "Batswing" shaped flame, which stands out openly like a gas flame, with nothing to obstruct the light. The necessary draft for perfect combustion is produced by a durable mechanical movement, which drives a fan wheel for this purpose, and also a double acting pump for supplying the oil to the wick at the point of combustion. The movement is placed in the bottom of lamp, and out of sight; it is driven by a heavy coil spring, which, when wound up, gives an initial force of twenty pounds. By the arrangement of the lamp the oil is kept at the same elevation until the supply is exhausted—the overflow returning to the oil tank—consequently uniformity of volume, and steadiness of flame are the result. After winding, this movement runs fifteen hours without attention. The impure and sedimentary matter in the oil is forced by the pump to the point of combustion, and is consumed, which is not the case in capillary attraction.

The wick by this arrangement is all used, one half inch in length giving as much light as would a new wick. Another important feature is, the carbon and gases are all consumed, and converted into light.

The following is extracted from Dr. Cresson's report to the Franklin Institute, Philadelphia, Pa.:

Continuous trial of 12 hours duration.

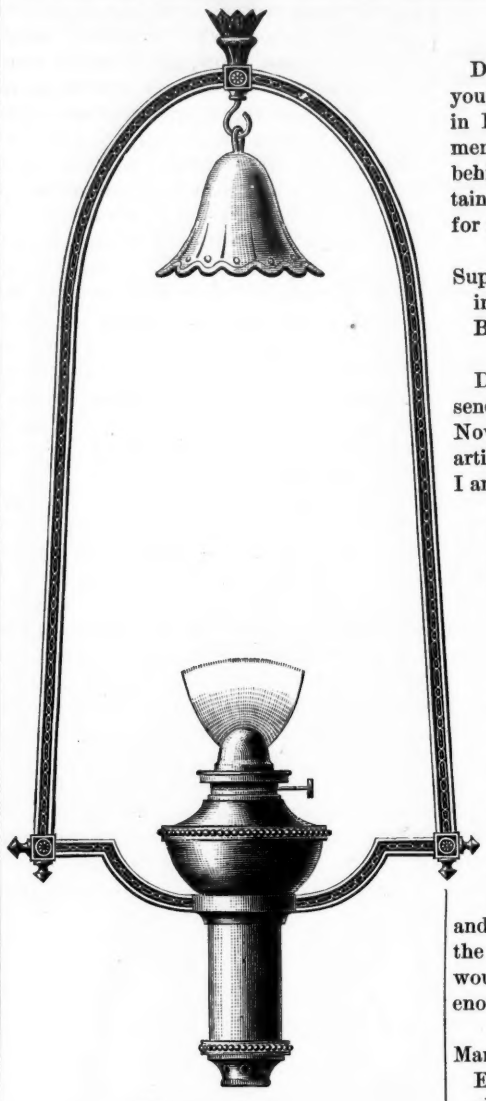
Hourly observations upon comsumption of oil.

Half-hourly observations upon candle power.

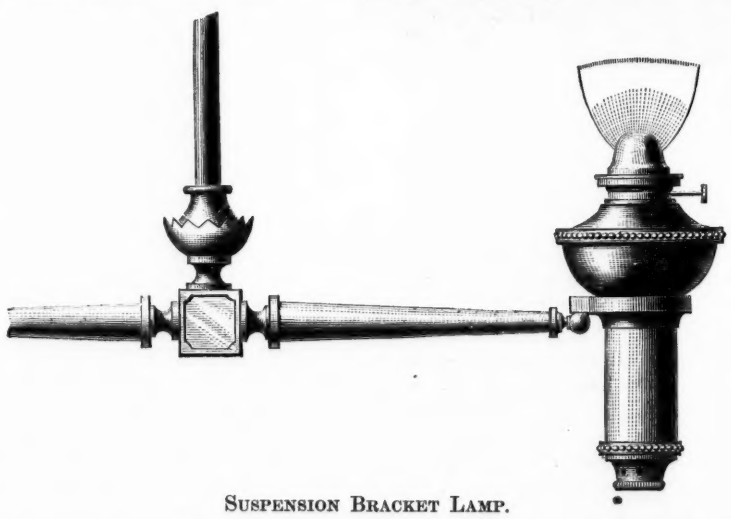
Average consumption of oil per hour =922.4 grains.

Average light produced, 16.9 candles.

Average consumption of oil per candle light, 54.5 grains, or one gallon of oil will give 16.9 candle lights for 57 hours.



Hanging Lamp.



Suspension Bracket Lamp.

WHEN SOLID LARD WAS USED.

Hourly consumption of lard, 882 grains.

Light produced, 14.85 candles.

Average consumption of lard per candle light, 59.4 grains.

One pound of lard gives light of 117.8 candles.

Trials with Thackara & Buck's best lard oil burner, with glass chimney 8 in. high, gave

Average consumption of oil per hour, 805 grains.

Average light, 13.4 candles.

Grains of oil per candle light, 60.5.

The ordinary solar lamp could not be made to yield over 16 candles, and burned best at 13.5 candles, and at all times was very sensitive to cross drafts and motion of the lamp.

The Hitchcock Lamp gave decidedly the most satisfactory results, with the great advantage of the absence of a glass chimney, behaving well when placed in a strong draft of air or when carried from place to place.

Car candles, used for comparison, burned 209 grains per hour, and gave a light of 2 2 standard spermaceti candles. Consumption, 120 grains of sperm per hour.

The above results are given in Standard candle lights.

Beside the railroad and ship lamps above referred to, this company makes table, hall, office, and other styles of lamps for burning kerosene without chimneys. They have the artificial air blast, but, burning kerosene oil the pump is not necessary. The ordinary "B" size wick is used, giving the same amount of light as that of the lard oil lamp, and costing for oil the same as for that burned in the ordinary chimney kerosene lamp.

There is no glass about the lamp, all being of hard brass, and nickel plated. There is no possibility of an explosion under any circumstances.

The Hitchcock Lamp Company are now making a mechanics' shop lamp, for burning lard oil without a chimney, or globe, that will give twenty-five candle power of light. It is wholly of heavy sheet brass, and not liable to injury from falling and breaking.

As one very noticeable feature about the railroad lamps, there is no lamp shadow in the car, or room.

In passing under the center lamps as they are placed in the Wagner sleeping cars, one will find that it is lighter under the lamps than elsewhere in the car.

The machinery employed in their manufacture is of the finest construction, without regard to cost, being especially adapted to this work. It was designed and built at the Company's Works, in Watertown, N. Y. It being, like the lamps, made of the best material, in the best possible manner, we see no reason why both should not last a lifetime.

rs from Machinery Establishments.

Dear Sir:—I am already a subscriber to your valuable paper through my news agent in Boston, as are also some ten or a dozen men in my shop. I should consider myself behind the times without it, as I think it contains valuable information in every number for all interested in machinery.

Yours truly, S. W. Jamison,
Sup't. S. W. Jamison Boot and Shoe Crimping Machine Co., 133 Summer Street, Boston, Mass.

Dear Sir:—I enclose stamps, and please send me, if you can, copy of your issue of November. 1878. I want to get Mr. Lyne's article about setting Locomotive Valves, and I am anxious for that article about the proper method of Squaring Locomotive Driving Boxes. I am much pleased with your paper, and like the practical articles of many of your writers. It is easy to see that they have been there.

Respectfully yours,
Alonzo Dolbear,
Foreman P. R. R. Machine Shop, Sunbury, Pennsylvania.

Editor American Machinist:

My Dear Sir:—I see by this week's issue of your most excellent paper, that my advertisement has been repeated. This is a mistake, as I had, or rather have secured the services of a draughtsman, and the number of applicants from all over the country that have written, or called, would convince you that one insertion is enough. Very respectfully yours,

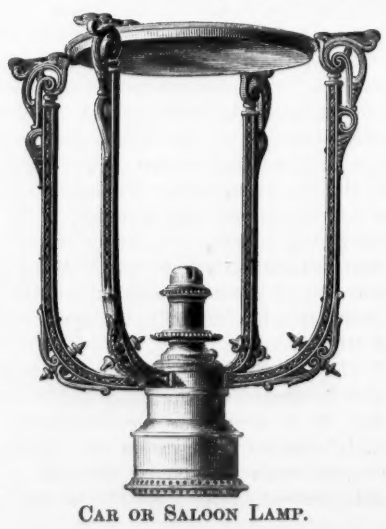
Wm. Munzer,
Manuf'r. of Steam and Hoisting Engines, Elevators, Brewers' and Maltsters' Machinery, etc., 503 to 507 First Ave., N. Y.

American Machinist:

I enclose a check for $3.00 for a year's subscription to the American Machinist. You may count me as a regular subscriber, until you start a patent agency in connection with the paper; for what is needed in this business is a straightforward paper that is confined to its specialty, and is not bought and sold at so much per line or inch from beginning to end.

I wish to offer a suggestion: A weekly list of machinery patents would be an attractive feature. Most machinists are inventors, and must continually watch this special hobby. The Official Gazette, issued by the Patent Office, is altogether too costly for general circulation, and most of it is utterly useless to one who has but a small field to keep an eye on.

An alphabetical list, giving name and address of inventor, should be headed by the statement that the full specification with drawing of any patent can be had from Washington for 25 cents, and that the office issues, gratis, a pamphlet of instruction for taking out patents and transacting business with the office. The patent agency journals sell the specifications at one dollar each, and make it known that the only way to reach the patent office is through their paid assistance. Yours, G. B. Grant,
Manuf'r Calculating Machines, Gears, &c.
94 Beverly St, Boston, Mass.



Car or Saloon Lamp.

Yonkers, Sept. 12th, 1879.

Editor American Machinist:

Under the heading "Useful Information for Engineers," appears a very common error that it may be well to correct in passing.

Table Lamp.

An example is given of a cylinder 10 inches diameter, the area of which is assumed to be 78.54 ins.

As most pistons 10 inches diameter, have a piston rod through which the power is transmitted, as the area of the piston covered by the piston rod is non-effective, it is evident that the area of the piston rod should be deducted from piston to get the correct area.

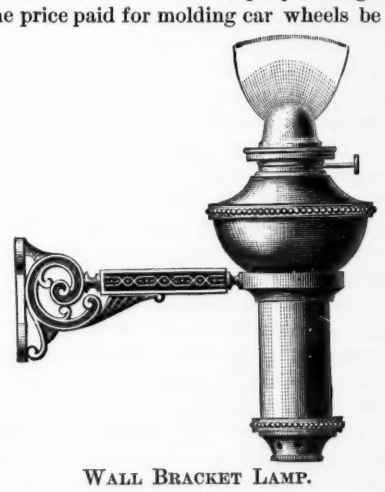
Assuming the diameter of piston rod for a 10 inch piston to be 1⅝ inches, the area would be 2.07 inches, then 78.54—2.07 =76.47 as the area of the crank side of the piston.

Where the power of an engine has frequently to be calculated, a convenient method is to deduct from the area of the cylinder half the area of the piston rod, thus 78.54—1.03=77.51 ins. effectual area.

You, Mr. Editor, may think this rather a small matter; but I take the ground that if anything is worth doing, it is worth doing well. If any of your readers should heed this little advice, it may save them some mortification at some future time.

Respectfully yours,
W. H. Odell.

A strike of molders was inaugurated at the Ohio Falls Car Works, at Jeffersonville, Tuesday. Monday morning the moulders, through a committee, sent a communication to the officers of the company asking that the price paid for molding car wheels be increased; that the wages of the men on the side floor, moulders for the freight car department be raised from $2 per day to $2.25. The committee was requested to call again, by which time the officers would be ready to reply. At the second meeting the request of wheel molders being considered reasonable it was complied with, and it was agreed to advance their pay. In the matter of the wages of moulders on the side floor, the company made a proposition that the superintendent of the works and one of the moulders, to be elected by his comrades, should visit all the prominent car shops in the country, and ascertain the wages paid for similar work in those shops; that the average price found to prevail would be paid to the moulders of the Ohio Falls Co.; and that any change resulting from the investigation should date from Sept. 10. Without making any reply, the committee left. Next morning all the moulders on the side floor quit work in a body. As it was impossible to run the freight department without the foundry it was closed out, thus adding to the number of idle men. A few men were retained to complete so much of the work as castings had been made for. The passenger shops are not affected.—*Railway Review.*



Wall Bracket Lamp.

Expert Trial of an Injector.

Last spring the editor of *Appleton's Cyclopædia of Applied Mechanics* asked permission of Wm. Sellers & Co. to make a series of injector trials, with a view to publishing the results in that book. They accepted the proposition, and during May, 1879, the *Park Benjamin Scientific Expert Office*, of New York, undertook the tests, Mr. Richard H. Buel, C. E., being placed in charge.

These experiments were most thorough and exhaustive. We publish below that part relating to the injector as a whole.

"THE SELLERS INJECTORS.—*Report of Tests Conducted by Park Benjamin's Scientific Expert Office, May*, 1879, *at the Works of Messrs. W. Sellers & Co., Philadelphia. Trials in charge of Richard H. Buel, C. E.*

"*Preparations and Conditions.*—The supply-water for the injectors was delivered through a pipe in such a manner that it could be run into a tank elevated above the level of the injector into a tank below this level, or could be admitted directly to the injector under the pressure in the main, as desired. It could also be drawn directly from the pipe, or through a Worthington water-meter. Both the supply and the delivery pipes connected with the injector were provided with cups through which water was allowed to escape from these pipes, and in which a thermometer could be placed for the purpose of ascertaining the temperature of the feed and delivery water. The steam-supply pipe leading to the injector was provided with a throttle-valve, for the purpose of reducing the steam pressure when desired; and a sensitive pressure gauge was connected to the steam pipe between the throttle-valve and the injector. This same pressure-gauge could be connected with the delivery pipe between the injector and the check-valve of the boiler, so that it could be used to indicate the water pressure by closing the valve in the pipe connecting the gauge with the steam pipe, and opening the valve in the pipe connecting the gauge with the delivery pipe. The delivery pipe was connected directly with the feed pipe of the boiler that supplied steam to the injector, and there was a safety-valve in the delivery pipe (which could be loaded to any desired pressure) between the injector and the check-valve of the boiler. A large Harrison boiler, having 48 square feet of grate surface, and consisting of 1088 cast-iron spheres, each 8 inches in diameter, was used to furnish steam for the experiments. The boiler was managed by an exceptionally expert fireman, who maintained the steam pressure at any point required without sensible variation. The water-supply pipes were so arranged, that by heating water in the elevated tank previously mentioned (which could be done by blowing live steam into the tank, or feeding hot water into the tank by the injector), cold water could be mixed with this in any desired proportion, in the pipe connecting the tank with the supply pipe of the injector, so that the highest temperature of feed water admissible could readily be determined.

"A scaffolding was constructed on the roof of the testing-room, and steam, supply, and delivery pipes were provided, for connecting the injector at a considerable elevation above a portable tank in the testing-room, for experiments with lifts greater than could be measured when the injector was used on the lower level The supply pipe for high lifts was made in sections, so that the lift could be readily varied. A sensitive chemical thermometer was used for measuring temperatures, and this was tested by being placed in boiling water, and in melting ice, and found correct at these two points. The water-meter was also carefully tested by running water through it at various rates into a tank of known capacity. It was found that the readings of the meter was somewhat in excess, the results of a number of trials, at various rates, giving an actual delivery of 45.4 cubic feet for a delivery as indicated by meter of 46.3 cubic feet; so that the proper correction for delivery was made by multiplying the readings of the meter, in every instance, by

$$\frac{45.4}{46.3}=0.981.$$

"*The Injectors.*—Three patterns of injectors were tried in these experiments, and descriptions of each, with results obtained are appended. All the injectors had the same numerical size, No. 6, the number indicating that the smallest diameter of the delivery tube was 6 millimeters, or 0.2362 inch. This dimension was carefully measured in the case of each injector.

"The general features of the injectors used in these experiments cover, with the exception of special details of construction, nearly all the varieties in the market; illustrating—

"1. The injector with automatic adjustment of combining-tube and water supply, in connection with a lifting attachment;

"2. The non-adjustable injector with fixed nozzles, non lifting;

"3. The non-adjustable injector with fixed nozzles, in connection with a lifting attachment.

"These instruments have, however, some special details of construction, as will appear by the descriptions that follow.

"1. *The Self-Adjusting* 1876 *Injector.*—An elevation of this injector is shown in Fig. 1, and a sectional view in Fig. 2. The injector is self-contained, or in other words, it has both steam and check-valves, so that it can be connected directly without other fittings, although, of course, it is generally desirable to place another stop-valve in the steam pipe,

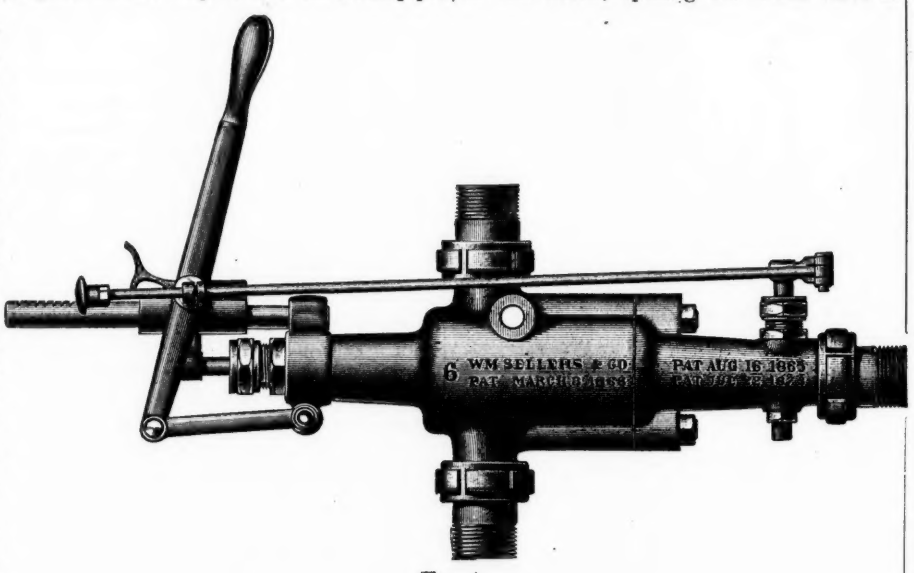


FIG. 1.

and a check-valve in the delivery pipe, so that the injector can be taken to pieces, or disconnected, at any time. Another important feature of this injector is, that it is operated by a single handle, and that the waste-valve is only open at the instant of starting.

"Referring to Fig. 2, *A* is the receiving-tube, which can be closed to the admission of steam by the valve *X*. A hollow spindle passing through the receiving-tube into the combining-tube is secured to the rod, *B*, and the valve *X* is fitted to this spindle in such a way that the latter can be moved a slight distance (until the stop shown in the figure engages with valve *X*) without raising the valve *X* from its seat. A second valve, *W*, secured to the rod *B*, has its seat in the upper side of the valve *X*, so that it can be opened (thus admitting the steam to the center of the spindle) without raising the valve *X* from its seat, if the rod *B* is not drawn out any farther, after the stop on the hollow spindle comes in contact with the valve *X*. *D* is the delivery-tube, *O* an overflow opening into space *C*, *K* the check-valve in delivery pipe, and *P R* the waste-valve. The upper end of the combining-tube has a piston, *N N*, attached to it, capable of moving freely in a cylindrical portion of the shell *M M*, and the lower end of the combining-tube slides in a cylindrical guide formed in the upper end of the delivery-tube.

"The rod *B* is connected to a cross-head which is fitted over the guide-rod *J*, and a lever, *H*, is secured to the cross-head. A rod, *L*, attached to a lever on the top end of the screw waste-valve passes through an eye that is secured to the lever *H*, and stops *T*, *Q* controls the motion of this rod, so that the waste-valve is closed when the lever *H* has its extreme outward throw, and is opened when the lever is thrown in so as to close the steam-valve *X*, while the lever can be moved between the positions of the stops *P*, *Q* without affecting the waste-valve. A latch, *V*, is thrown into action with teeth cut in the upper side of the guide-rod *J*, when the lever *H* is drawn out to its full extent and then moved back; and this click is raised out of action as soon as it has been moved in far enough to pass the last tooth on the rod *J*. An air-vessel is arranged in the body of the instrument, as shown in the figure, for the purpose of securing a continuous jet when the injector and its connections are exposed to shocks, especially such as occur in the use of the instrument on locomotives.

"The manipulation required to start the injector is exceedingly simple—much more so in practice, indeed, than it can be rendered in description. Moving the lever *H* until contact takes place between valve *X* and stop on hollow spindle, which can be felt by the hand upon the lever, steam is admitted to the center of the spindle, and, expanding as it passes into the delivery tube *D* and waste orifice *P*, lifts the water through the supply pipe into the combining tube around the hollow spindle, acting after the manner of an ejector or steam siphon. As soon as solid water issues through the waste orifice *P*, the handle *H* may be drawn out to its full extent, opening the steam valve *X* and closing the waste valve, when the action of the injector will be continuous as long as steam and water are supplied to it.

"To regulate the amount of water delivered, it is necessary only to move in the lever *H* until the click engages any of the teeth on the rod *J*, thus diminishing the steam supply, as the water supply is self-regulating. If too much water is delivered, some of it will escape through *O* into *C*, and, pressing on the piston, *NN*, will move the combining tube away from the delivery tube, thus throttling the water supply; and, if sufficient water is not admitted, a partial vacuum will be formed in *C*, and the unbalanced pressure on the upper side of the piston, *NN*, will move the combining tube toward the delivery tube, thus enlarging the orifice for the admission of water. From this it is evident that the injector, once started, will continue to work without any further adjustment, delivering all its water to the boiler, the waste valve being kept shut. By placing the hand on the starting lever, it is easy to tell whether or not the injector is working; and, if desired, the waste valve can be opened momentarily by pushing the rod *L*, a knob on the end being provided for the purpose.

"*Experiments with the Self-Adjusting* 1876 *Injector.*—In the experiments made with the injector described above, a No. 6 instrument was employed, selected at random from a lot in stock. It was run for considerable intervals of time at pressures varying by 10 lbs. from 10 to 150 lbs. per square inch, the manipulation described above being observed in each instance; and at all pressures the adjustment of the water supply was perfect for all positions of the starting lever, within the capacity of the instrument.

"Table I. shows the results of the experiments on delivery of injector, temperature of delivered water, and other particulars, which are fully detailed in the general heading and in the several columns. For each pressure of steam noted in column 1, the water was delivered by the injector into the boiler under approximately the same pressure. The delivery was measured by observing the indications of a water meter, and correcting the readings as already described, meter readings being taken at frequent intervals, and each experiment being continued for a sufficient length of time to obtain a number of duplicate readings for equal intervals. The pressures in column 8 were obtained by throttling the steam supplied to the injector and observing the pressure at which it ceased to work, each experiment being repeated several times with precisely the same results. The temperatures in column 9 were obtained by gradually heating the water supplied to the injector and noting the temperature at which it ceased to operate, each temperature recorded being checked by several repetitions of the experiment.

TABLE I.—Maximum and Minimum Delivery of the Self-Adjusting 1876 Injector, No. 6; Temperature of delivered Water, Pressure against which Injector delivers Water, and Highest Temperature admissible of Feed. Water flowing to Injector under 15 inches Head. Waste-valve shut.

Pressure of Steam supplied to Injector, and Pressure against which Water is delivered. Lbs. per sq. in.	Delivery in Cubic Feet per Hour.			Temperature, Fahrenheit Dgs.			Pressure of Steam required to deliver Water against Pressure in Column 1.	Highest Temperature admissible of Feed-Water, Fahrenheit Degrees.
	Maximum.	Minimum.	Ratio of Minimum to Maximum Delivery	Feed-Water.	Delivered Water.			
					At Maximum Delivery.	At Minimum Delivery.		
1	2	3	4	5	6	7	8	6
10	75.3	63.6	0.845	66	100	94	3	132
20	82.4	61.2	0.743	66	108	104	9	134
30	94.2	56.5	0.600	66	114	116	16	134
40	100.1	60.0	0.599	66	120	123	22	132
50	108.3	64.7	0.597	66	124	25	27	131
60	116.5	63.6	0.546	66	127	133	34	130
70	124.8	63.6	0.510	67	130	142	40	130
80	133.0	67.1	0.505	69	134	144	46	131
90	141.3	69.5	0.492	67	136	148	52	132
100	147.2	64.7	0.456	66	140	159	58	132
110	153.0	67.1	0.439	67	144	162	63	132
120	156.6	73.0	0.466	67	148	162	69	134
130	161.2	74.2	0.460	66	150	165	75	130
140	166.0	78.9	0.476	66	153	166	81	126
150	170.7	70.6	0.414	66	157	167	88	121

"Table *II.* shows the performance of the injector when lifting water 5 feet. The injector, as ordinarily constructed for use with high-pressure steam, has a spindle with a hole which is rather too small for low pressures; so that a spindle with a larger opening was attached in all but the last experiment, when the high-pressure spindle was replaced. The low-pressure spindle was such as is fitted in injectors designed for use on steamboats and other places where the pressure is ordinarily less than that carried in locomotive boilers.

TABLE II.—Maximum and Minimum Delivery of the Self-Adjusting 1876 Injector, No. 6; Temperature of delivered Water, and Pressure against which Injector delivers Water. Feed-Water lifted 5 Feet. Waste-Valve closed.

Pressure of Steam supplied to Injector, and Pressure against which Water is delivered. *Lbs. per Sq. In.*	Delivery in Cubic ft. Per Hour.			Temperature Fahrenheit degs.			Pressure of Steam required to deliver Water against Pressure in Column 1.
	Maximum.	Minimum.	Ratio of Minimum to Maximum Delivery.	Feed-Water.	Delivered Water.		
					At Maximum Delivery.	At Minimum Delivery.	
1	2	3	4	5	6	7	8
30	84.8	53.0	0.625	68	123	124	16
60	114.2	67.1	0.559	68	130	134	34
90	137.7	65.9	0.479	68	139	152	51
120	150.7	77.7	0.516	68	149	156	70
150	150.7	88.3	0.586	68	170	160	97

"To obtain the vacuum in the supply-pipe, as recorded in Table III., a short supply-pipe was used, having a vacuum gauge connected to it, a globe-valve at the lower end of the

pipe being immersed in a tank of water, so that the injector and supply-pipe could be heated by blowing steam through the supply-pipe, and could be cooled quickly to ordinary temperature by allowing the injector to draw water from the tank.

TABLE III.—Vacuum in the Supply-Pipe of the Self-Adjusting 1876 Injector, No. 6.

Pressure of Steam supplied to Injector, *Lbs. per sq. inch.*	Vacuum in Supply-Pipe—Inches of Mercury.			
	Injector fitted with Spindle having large hole.		Injector fitted with Spindle having small hole.	
	Injector at Ordinary Temperature.	Injector and Supply-Pipe as hot as the Steam can make them.	Injector at Ordinary Temperature.	Injector and Supply-Pipe as hot as the Steam can make them.
1	2	3	4	5
20	1	2½	....	...
30	4	1½	2	...
40	11	5	3	5
50	12	6½	3½	5
60	15	7½	5½	4¼
70	19¾	7½	6½	4¾
80	20½	8½	7½	5
90	20	7¾	8½	5
100	20½	4	9½	5½
110	19½	3	10¾	5½
120	19½	6	11	6
130	....	...	12½	6¼
140	....	...	13¾	6¾
150	....	...	19	7

"Experiments were then made to determine the steam-pressure required to lift water and start the injector, for such lifts as could conveniently be obtained in the testing-room, by throttling the steam until the lowest pressure at which the injector would start was ascertained. Using the high-pressure spindle, the pressure required for a lift of 3 ft. 4 in. was 33 lbs. per square inch; and for a lift of 5 ft., 47 lbs. per square inch. Lifting with this pressure, the injector delivered water against a pressure of 75 lbs. per square inch.

"Having started the injector with a pressure of 47 lbs. per square inch and a lift of 5 ft., the steam-pressure was gradually reduced, and the injector continued to deliver water until the steam-pressure was 10 lbs. per square inch, the water-pressure being 17 lbs. per square inch. Using the low-pressure spindle with larger hole, the steam-pressure required for a lift of 5 ft. was 30 lbs. per square inch. The injector and supply-pipe were then heated by blowing steam into the tank, and, with a steam-pressure of 150 lbs. per square inch and a lift of 4 ft., the injector was started in 3 seconds from the time of touching the starting-lever.

"Lifting water 5 ft., the highest temperature of supply-water with which the injector would start was as follows: With the high-pressure spindle and a steam-pressure of 120 lbs. per square inch, highest temperature of supply-water, 123°; 90 lbs., 130°; 60 lbs., 129°; and using the low-pressure spindle, at a steam-pressure of 30 lbs., 101°.

"Experiments on the least pressure with which the injector would start, the water flowing to it under 15 inches head, resulted as follows:

"With a free discharge through safety-valve in delivery-pipe, equivalent to a water-pressure of 5 lbs. per square inch, the least steam-pressure with which the injector would start was 7 lbs. per square inch.

"Discharging into the boiler against a pressure equal to that of the steam, the least steam-pressure with which the injector would start was 8 lbs. per square inch.

"When the injector was started, delivering water against a pressure of 5 lbs. per square inch, the steam-pressure was reduced by throttling to one-half pound per square inch before the injector ceased to work.

"Lifting 5 ft. with a steam-pressure of 120 lbs. per square inch, and a supply-pipe having one end free, the supply-pipe was violently shaken for the purpose of stopping the injector, if possible. It was found that this could be done, but only by a peculiar shock of great violence,—much more violent, in fact, than would ever be likely to occur in practice.

"Finally, the amount of water wasted in starting the injector was carefully measured, the average of a number of trials being 36 cubic inches, or about 1¼ U. S. pints.

Schemes for Revolutionizing Steam Engine Economy.

BY STEPHEN ROPER, ENGINEER.

In connection with the recent statement, in some of the foreign scientific journals, that John Bourne, the celebrated engineer and writer on the steam engine, declared that the days of the steam engine were numbered, and the indorsement of the Keeley motor by a celebrated expert, author and scientist, who was once Chief Engineer of the U. S. Navy, it may be asserted that since the days of Newcomen hardly a "decade" has passed which has not witnessed the promulgation of some vague scheme, which, it was claimed, would revolutionize the economical working of the steam engine. Strange as it may seem, very few of them originated with ignorant or inexperienced men, but, on the contrary, in nearly all cases, with persons who, on account of their education and experience, might have been expected to see, at a glance, the incorrectness of their theories.

Not to go back more than a quarter of a century ago, a high pressure compound engine, in which the steam was exhausted from one cylinder into another, and then into the atmosphere, was claimed to be conducive of great economy; and this idea was carried to such an extreme in England that steam of a high pressure was exhausted into four cylinders in succession, so that the arrangement embodied all the necessary adjuncts for four steam engines. Besides the extra cost of construction, maintenance, the loss induced by friction, &c. (as might have been expected), the arrangements failed to produce satisfactory results and was soon abandoned. Compound high pressure engines, with a cylinder within a cylinder, were next claimed to be the only practicable means of rendering the steam engine economical, but (as it is well known that every obstruction offered to the escape of the steam from the cylinder after it has done its work increases the back pressure, and, as a result, decreases the power of the engine, as this arrangement necessitated the construction of two cylinders for each engine, with only one piston, and as the cylinder is one of the most important as well as the most expensive part of the steam engine) it was found that such an arrangement nearly doubled the first cost and cost of maintenance without perceptibly increasing the economy of the engine; therefore it has been abandoned.

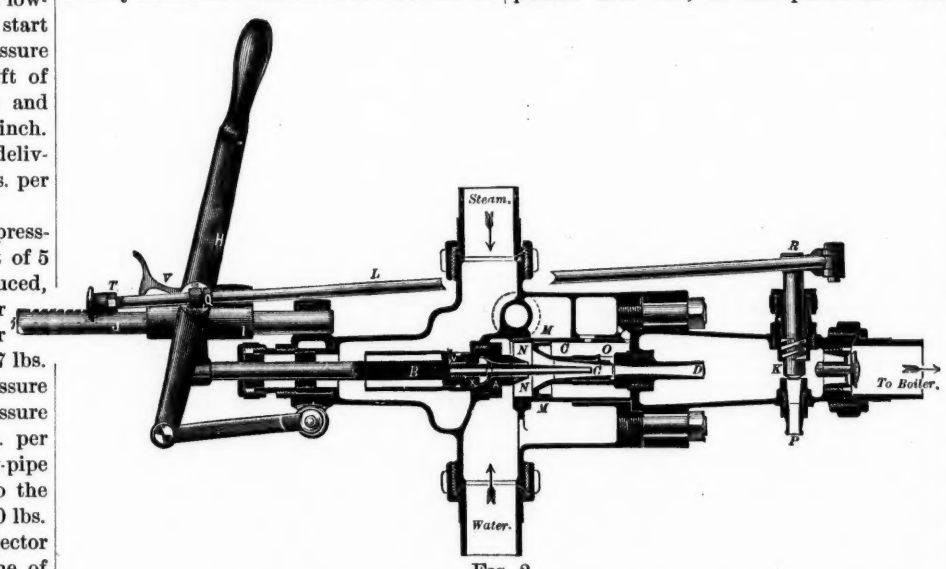


FIG. 2.

Later it was claimed that super-heated steam of a high pressure would effect an immense saving in the working of steam engines, but practical experience, as well as a number of experiments, demonstrated the folly of this theory. Thousands of dollars were expended on the engines of the celebrated Collins line of steamships in arrangements for superheating the steam, all of which proved a failure, as the apparatus was rapidly destroyed by the heat to which it was exposed. Besides, the cylinders, pistons, valves, valve sheets and joints rapidly deteriorated, when exposed to the action of the gas, into which the steam was converted in the process of superheating.

Then the compound engine was re-introduced, which embodied both the condensing and non-condensing principles, and which, it was claimed, would be productive of more economical results than any former experiments; but, although there have been several hundred of them in use, for both stationary and marine purposes, the question is not definitely settled as to their actual economy. It has been shown by numerous indicator diagrams that many of the simple engines on the steamship lines running out from New York harbor are more economical than the most compound engines. This, taken together with the fact that the first cost and weight of the compound engine greatly exceed that of the simple, the question naturally arises: If the modern non-condensing and condensing compound engine is not a failure, is it a success?

Next we had the double piston engine, which, it was claimed, would develop more power, with the same caliber and weight of material, than any other design or arrangement in use at the present day. This latter claim can only be proved by experience and actual practice, as, while there may be some good features in the double piston engine, there are others that are decidedly objectionable—such as two piston heads and three rods. Now, it is well known that, if there is any mechanical arrangement employed in connection with the steam engine that is more to be avoided than any other, it is more pistons than one, as the piston has ever been a source of waste in the steam engine. The records of the Patent Office—old and new—show, by the great variety of devices invented by ingenious mechanics, at different times, that the piston must always have been, since the advent of the steam engine, a source of anxiety and loss to the steam user, and annoyance to the engineer. Besides, the three piston rods must have the corresponding number of stuffing boxes, which increases the friction of the engine and the cost of maintenance, which suggests the question: Whether, if all that is claimed in increase of power for the two-piston engine be true, these advantages more than balance, or exceed, to any great extent, the future outlay, to keep it in order?

Lately, very high claims have been set up for the economy of high speed engines, in which a piston speed of a thousand feet per minute is obtained. The high speed engine, like the modern compound engine, is not a new idea, as history is repeating itself in this, as in many of the foregoing cases. The high-speed engine was advocated in England nearly fifty years ago, but has never met with much favor in this country until recently. Then it was found, by experience, that engines, to develop such high piston velocities, must be so designed as to possess great strength and rigidity, and must be built with great care and of special material, which increases the first cost and cost of maintenance. It has been demonstrated by experience that neither fast nor slow running engines are economical, and that the most satisfactory results have been obtained from all classes of steam engines with moderately high piston speeds and corresponding pressures. Nevertheless, Chas. T. Porter, the celebrated engineer and expert, is an advocate of the high-speed engine, and, as he is a mechanical engineer of more than ordinary ability, it is fair to assume that he is able to explain the advantages of that class of machines.

The most recent innovation on this subject, has been enunciated in a series of articles, entitled "Engineering Popularized," which have appeared in the MACHINIST, in which it is asserted that the economy of steam engines is increased by compressing the steam up to the initial pressure, at each return stroke of the piston. Such a theory, however, has never been indorsed by any great number of talented engineers, either in this country or Europe. Rankine suggested such a thing, but his ideas were based entirely on theory, and not on actual practice or experiments. The party that would place as heavy a load on a wagon as a horse could possibly draw, on a level, and then when he was ascending a grade, place a brick-bat, or a block of wood before the wheel, would be considered a brute. Similarly any attempt to compress the steam up to the initial pressure at the end of each stroke places the steam engine in the same position as the horse, and is tantamount to applying a brake to the driving pulley, when the engine is at its weakest point, as, if not for the momentum of the balance wheel, it would be completely helpless. It takes power to compress steam that has been once expanded, and that power has to be absorbed from the momentum of the fly-wheel, and must be restored before the point of cut-off is reached.

Theoretically speaking, there is nothing to be gained by compressing the steam up to the initial pressure, as if the energy given out by the compressed steam represents just the amount of power absorbed in compressing it, and if the loss of capacity in the cylinder be about equal to the loss of heat that would be incurred, by filling the clearance space with a fresh volume of steam at each stroke of the piston, the claim of economy by compression, rests on very doubtful grounds. If any one could establish the fact that economy might be promoted by changing money from one pocket to another, as Col. Mulberry Sellers would say, "There's millions in it."

Bold assertions, and blank denials, never establish anything. We have had a good deal of discussion, pro and con, but no definite settlement of the question, and, as we are all interested in any proposal that bears upon the economy of the steam engine, it would be very interesting to many of us to have Messrs. Church, Hoffman, and other advocates of the compression or re-compression theory, come down to figures, and show the actual gain induced by compressing the steam up to the initial pressure; and demonstrate, by facts and figures, the relative economy of different engines of the same type, and also the amount of fuel that may be saved or wasted, in any individual case, in a given time, by altering or adjusting the valves, so as to work the same engine under the two different conditions. There are one or two other points which would bear a little explanation, and which ought to be definitely settled, before proceeding further in this line of discussion; first, do such lightning changes in temperature as are claimed by the advocates of the compression theory, actually take place in the walls of the cylinders of steam engines, at each stroke of the piston; second, does steam, which has been expanded down to atmospheric pressure, or nearly so, when re-compressed up to the initial pressure, possess a temperature corresponding to that pressure?

We have had in the treatment of this subject, too much theorizing by far, and not enough of stubborn facts. Most intelligent engineers are of the opinion that the right amount of compression is that which reaches the requirements and the circumstances under which the engine is to work, and is working, and no amount of theory however finely spun, will suffice, as it must be the result of experiments in each individual case. Compression to any extent, except in extreme cases, is not necessary, either as a means of inducing smooth working, or as a condition of economy.

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CONTENTS.

	PAGE.
New Tubulous Steam Boiler	1
Extracts from Chordal's Letters	2
Engine Proportion and Construction. W. H. Hoffman	3
Activity not Energy	3
The Poetry of Iron	3
New Reflecting Candlestick	4
Piston Speed and Steam Compression. Chas. A. Hague	4
The Hitchcock Lamps	5
Letters from Machinery Establishments	5
Expert Test of an Injector	6
Special	8
The Demand for Competent Machinists	8
Trashy Machinery	8
Machine Shop Wages	8
The Cincinnati Exposition	8
All About "Chordal"	9
Questions and Answers	9
Manufactures	9
Machinists' and Engineers' Supplies	10

Prices of iron, hardware, machinery and lumber are advancing. Wages of skilled mechanics are taking an upward turn and employment is comparatively easy.

Special.

We wish to make the following facts fully understood by our readers:

1st. That nobody has ever paid the publishers of the AMERICAN MACHINIST one cent for anything inserted in its reading columns, either for illustrated descriptions of machinery and tools, contributed articles, editorials, manufacturing notes, book reviews or reviews of shop supplies.

2d. That we never will publish any notice for pay, either direct or indirect, except in our advertising columns.

3d. That no party interested in making or selling machinery, engines and boilers, or in their manipulation has, or ever has had any pecuniary interest in the AMERICAN MACHINIST.

The Demand for Competent Machinists.

Accompanying the increased activity in the iron and machinery trades comes a positive and continuous demand for skillful and energetic machinists. While the supply of ordinary labor and of second and third rate mechanics is beyond immediate requirements, the most diligent inquiry is necessary to obtain the services of any number of thorough, first-class machinists. There is, indeed, in the dullest times a demand for competent workmen in nearly all the manufacturing industries, but without a fair degree of business activity their services are not amply rewarded. On the other hand, an inferior grade of tradesmen find in seasons of industrial depression, a difficulty in securing even comfortable living wages. Complaints become rife, and strikes prevent and destroy the substance of productive labor. It is the "old, old story," yet fails to impress its lesson upon more than one in ten of the anxious toilers in the workshops of our country. Thousands of artisans are inclined to drift with the tide and to acquire the mastery of only such mechanical details as are thrust upon them, in the special departments in which they chance to find employment. While this is satisfactory to employers, as it trains up a class of workmen, each to perform a particular kind of mechanical manipulation, at common wages, it should not be satisfactory to an intelligent, industrious and ambitious artisan, because it restricts his advancement and material prosperity. The division of labor practised in most large machinery establishments, doubtless cheapens the production, as it requires but the lowest expenses for mechanical labor, therefore it cannot be expected that employers will, as a rule, urge their workmen to learn the trade in all its branches. Every workman must qualify himself—not by accident, but by persistent effort—for the position he expects to occupy. It is not enough that he learn just enough to permit him to obtain and hold a situation. Twenty years of such labor, steady though it be, will place a workman, whether he has a family or remains single, in a position with no more resources to fall back upon than he had to start with. The great prerogative of the American mechanic, self-employment, in an independent business, can not be made available by a workman unless he takes special pains to learn his trade. How shall a man rise to a position of superintendent or master mechanic, with a salary that will enable him to save the means to establish himself in business, unless he has thoroughly learned the trade he pursues? At the present time glowing opportunities are presented to thoroughly skilled mechanics. Rates of wages are advancing, and men who are qualified to lead and direct in machine shop work are earnestly sought for.

To those who believe that the field for mechanical success is overcrowded, we commend the reply of Daniel Webster, who upon choosing to enter upon the study of law, was urged to abandon this purpose as the profession was so full as to afford little room for more. Said he "There is plenty of room at the top." So it is in every branch of practical mechanics. The men who are content to elbow along through the crowds at the bottom never find room enough, but those who push their way upward find more and more room, and fruitful fields for operations.

Trashy Machinery.

During periods of business depression efforts to obtain goods cheap are put forth with restless activity. This opens prolific opportunities for unscrupulous manufacturers to sell inferior productions at what appear to be low prices, giving the impression that they are of a better quality than is really the case. To take advantage of these opportunities is nothing but commercial trickery, and no amount of professed logic like the following, which we clip from a mechanical exchange, can make it appear otherwise:

To this desire to *buy cheap* may be traced the effort to meet it, on the part of manufacturers, by the production of cheap machinery, and the phrase cheap machinery can, in truth, be taken to mean machinery cheaply constructed of poor or an inferior quality of material, by incompetent mechanics, who can be, and are, employed at a low rate of wages, and whose work is worth really less than they receive for it. The demand for cheap machinery exists, and, so long as it does, a supply to meet it will be found. The manufacturer cannot be blamed for endeavoring to meet this demand. He has his money invested in machinery, tools, shops, etc., and is compelled to meet the demand made upon him, and even to enter into competition with other manufacturers, in order, if possible, to still further cheapen his products, or else he must abandon his business, lose the money he has invested, and seek some other avenue through which to make his capital productive. There is not a reputable manufacturer in the United States to day but would prefer to make a first-class machine rather than a poor one, did he believe, or have reason to believe, that the demand for it would warrant its production; but the fact that, in a large majority of cases, competition in price predominates over competition in quality forces upon him the alternative of lowering his standard of excellence or losing rapidly upon his investment. It is not difficult to determine which horn of the dilemma he chooses. The purchaser alone is responsible for the cheap machinery with which the market is flooded, as, should he be willing to pay a fair price for a good article, inferior goods would find no sale.

The above effusion is veritable bosh, yet it is the course of reasoning we generally find set forth by the builders of shoddy machinery as an excuse for their questionable methods of conducting business. The attempt to shoulder off the disreputable part of this business upon purchasers, is too clumsy and feeble to call for any counter argument.

The average purchaser knows well enough that it is not prudent to pay the first-asking price of a Cheap John, whether he be in the machinery line, or in the second-hand clothes line, and accordingly gets him to come down as low as possible before concluding a bargain. When the same individual goes to a merchant, or manufacturer of good reputation to make a purchase, he does so with the assurance that his money will not be thrown away, and practices none of the tactics employed upon the Cheap John.

Those machinery houses that make the loudest complaints, about the unwillingness of purchasers to pay a fair price for a good article, are the very ones that are following out the course of reasoning advanced in the above quotation. They are apt to bewail the squeezing competition in price, and to endeavor by employing poor mechanics, and worse material, to outdo each other in cheapness.

Men do not buy machinery because it is cheap, but because they want it for use. No one can be blamed for supplying his wants at the lowest price offered. If machinery makers wage a contest, each to cut down his neighbor's profits, the cautious and well-informed purchaser is not at fault. There are machinery houses, we are glad to observe, that never enter such a contest, but are always ready to compete in excellence of productions with any rivals in the field. Now, that an era of business activity has dawned, those establishments that have been disposing of their wares by reason of cheapness, thereby loosing any reputation they may have had for quality of work turned out, are obliged to see the tidal wave receding, with an unpleasant prospect of finding themselves hopelessly stranded upon the beach. Good machinery is in demand, and good prices paid for it, but not to the makers of low priced trash. Poor machinery is being cast out as old junk where its merits and demerits have been proved by ample tests and its manufacturers also condemned.

Machinery purchasers will find that machine makers who express arguments like the one here quoted are first rate men not to patronize.

Machine Shop Wages.

We give below the rates of wages paid in a few of the machine shops of New York City. In no other city, so far as we can learn, are machinists better paid, taking rates of all the shops together.

The Quintard Iron Works (Marine Engines, Boilers and Machinery) pay lathe hands $2.75 to $2.80 a day; finishers, $2.00 to $2.80; apprentice boys, 80c. to $1.10; blacksmiths, $2.60 to $3.00; helpers, $1.55 to $1.65; boiler makers, $2.40; flange turners, $2.70; riveters, $2; helpers in boiler shop, $1.40; rivet heaters, (boys) 90c.; pattern makers, $2.80; carpenters, $2.25; engineer, $2.25; yard laborers, $1.20 to $1.30. One hundred and fifty hands are now employed.

The Morgan Iron Works, John Roach & Son, (Marine Engines, Boilers and Machinery) are employing a smaller force than they had last winter. They pay machinists $2.20 to $3.00 a day, the greater portion $2.30; iron moulders and blacksmiths, $2.20 to $2.50; boiler riveters, $1.90 to $2.00; fitters-up, $2 to $2.35, pattern makers, $2.75 to $3.00; draughtsmen, $5.00 a day downwards; engineer, $3.00; yard laborers, $1.40.

Fletcher, Harrison & Co. (Marine Engines, Boilers and Machinery) have 130 men at work, and will soon take on a number more. They pay machinists $1.50 to $3.50 a day, the larger portion of them receiving from $2.30 to $2.90; boiler riveters, $2.00 to $2.10; holders on, $1.60; chippers, calkers and soft patchers, $2.10; blacksmiths, $2.50 to $4.00; draughtsman, $4.25; pattern makers, $3.00 to $4.00; engineer, $2.80; assistant engineer, $2.50.

E. E. Garvin & Co. (Machinists tools) pay machinists $1.50 to $2.25; pattern makers, $1.75 to $2.25.

Wm. Munzer (Engines and Machinery) pays machinists $2.00 to $2.75, mostly $2.50; helpers, $1.50 to $1.75, blacksmiths same as machinists.

The Delamater Iron Works (Marine Engines, Boilers and Machinery) are employing 850 men, which is double the number employed last winter. They pay machinists $2 25 to $2.50 a day; boiler makers, $2.50; boiler riveters, $2.10 to $2.20; rivet heaters, 60c. to $1.25; moulders, $2.30 to $3.50, pattern makers, $2.75 to $3.00; blacksmiths, $2.50 to $2.75; engineers, $2.50, $2.75 and $3.25; yard laborers, $1.50.

Marvin's Safe Works employ 175 hands. They pay machinists $2.00 to $2.50; pattern makers, $2.50; blacksmiths, $2.00 to $3.00; engineer, $3.00; laborers, $1.25 te $1.50.

Arthur R. King (General Machine Shop) pays machinists from $2.25 to $2.50 a day; blacksmiths, $2.50 to $3.00; laborers, $1.50.

Herring's Safe Works pay machinists $2.00 to $3.50 a day; blacksmiths, $2.50 to $3.50; safe movers, 40 cents an hour.

The Cincinnati Exposition.

Our esteemed contributor, "Chordal," dates his "Extracts" of this week from the Cincinnati Exposition, whither he has betaken himself, as he delicately puts it, for the purpose of getting on the jury to judge the machinery of his own designing. From our long and intimate acquaintance with friend "Chordal," however, we are inclined to think he had better not succeed in this laudable effort, for several reasons. One is, the natural tendency of disappointed exhib-

itors to "cuss" the jury, and, being a sensitive plant, "Chordal" would find his peace of mind seriously disturbed, ever afterwards. Another is: Conscientiousness is so abnormally developed in "Chordal's" cranium that we fear the far-seeing instinct of the constructor in turning critic, would discover defects in his own work, which do not exist, and would begin to think up improvements, to the serious overlooking of present and conceded merits. It is needless to say that our readers will look with pleasure for the promised notes of observation upon this important exhibition.

All about "Chordal."

By way of improving our friend "Chordal's" chances of getting on the jury at the Cincinnati Exposition (if, after our earnest expostulation, he is still so minded,) we have thought it not amiss to go through the back numbers of the AMERICAN MACHINIST, and to make a list of the various topics touched upon (always with success) in the "Extracts from Chordal's Letters." We suspect that not even all the happy possessors of a complete file of the paper since July, 1878, when the first of the series appeared, fully realize the extent and variety of the information contained in these inimitable "Extracts." And while the discerning reader will not be slow to note that the original, mirth-provoking manner of the man—which makes his treatment of the driest mechanical subject as entertaining as a novel—is not, by any means, the least of his many merits, few persons, we fancy, will care to contest the practical value of these notable papers. Here is the list:

July, '78.	What to do with odd patterns.
	How far should purchasers' wishes influence machinery makers?
Aug., '78.	Tells a good deal about foremen.
Sept., '78.	Use of Chucks.
	Shop Heroics.
	A Glorious Mechanical Tramp.
	What he did, and how he did it.
	Doing Work too Well.
	Philadelphia vs. Yankee lathes.
Oct., '78.	Longevity of Shops.
	The Two Jours., Sackett and Wycoff.
	Wycoff's Shop Photographed.
	Too Many Superintendents.
Nov., '78.	Mrs. Toodles runs a Machine Shop.
	Her way of Buying and Using Tools.
	Drills and Drill Sockets.
Dec., '78.	Developing into a Stock Company.
	Screw Heads and Screw Threads.
	Charley at the Grindstone.
Jan'y., '79.	"Chordal" as a Machine Screw Missionary.
	Bottom Wear of Cylinders.
	How our Grandfathers did things.
	Pawtucket Engine Duty.
Feb., '79.	Backbone in Lathes.
	Sick Lathes and How to Cure them.
	Adjusting Belts.
	Core Pinion and Gear Wheel Teeth.
	Short-winded Planers.
	Small Shops and their first Planer.
	Mr. Sackett on Planers for small Shops.
	Sackett's Foundry Device for making Round Cores.
	Comparative Cost of Small Tools.
April, '79.	On Milling Machines.
	Yankee "Trappery."
	Mr. Sackett's Mechanical Time-Keeper.
	The Screwing-on Process versus Casting on.
	Screw versus Nut.
	Mr. Hunter's Experience with Foundry Accounts.
	"Chordal" as a Peacemaker.
	Ownership of Patterns and Negatives.
	The Master Mechanics' Association.
May, '79.	Ye Heartsick Tramping Jour.
	Narrow-Minded Workmen.
	How to get Up in the World.
	Keeping Mum about Wages.
	High Wages vs. High First Cost of Product.
	What Constitutes a Good Workman.
	Skillful Foremen and the Post Hole Business.
	Little Planers vs. Big Ones.
June 28,	The Standard Axle and Other Standards.
	About Raising Prices.
	Shop Nomenclature.
	Shop Bigotry.
	Sackett and Wycoff in Missouri Foundries.
	Saw Mill Emergencies.
	Devising Make-shifts.
July 5.	"Chordal" as a Musician.
	Altering Details to Suit Customers.
	Constructing a Grindstone Frame.
	Journal Boxes and How to Place Them.
	Hill's Experience with Lubricators.
	A Mechanical Time-Keeper.
July 12.	"Chordal" Ruining Files for a Living.
	Use and Abuse of Emery Wheels.
	Wanted—An Emery Wheel Man.
	Charley as the Champion Oiler.
July 19.	Disadvantages of Taking Things on Trial.
	New Shops vs. the Contracting System.
	More about Time-Keeping.
July 26.	Starting New Shops and Starting New Tools.
	"Chordal" as an Awful Example.
	Exit Valves for Tank Work.
	Wanted—A Missionary Bureau.
	Shop Ablutions.
Aug. 2.	"Chordal's" Experience in Starting a Foundry.
	Saugerties vs. Newark as Foundry Headquarters.
	Mr. Sackett on Pay Days.
Aug. 9.	Circulars, Photographs and Catalogues Dissected.
	"Chordal" helps Bill and Mike to Sort Castings.
	The Foreman tries *his* Hand at it.
Aug. 16.	Procrastination in Shops.
	Mr. Ingraham's Opening Day.
	How Common Sense Overtook "Chordal."
	On Millwrights.
	The Hap-hazard Manager.
	The Champion Organizer.
	Printed Rules in Shops.
Aug. 23.	Narrow-Mindedness in Machine Shops.
	Mr. Raven Punishes the Steam Gauge Man.
	Raising Twist Drills from Onion Seed.
	Tailor-made Books for Machinists.
	Mr. Torsion and the Apprentice.
	Bacon's Experience with the Indicator.
Aug. 30.	Scraped Surfaces.
Sept. 13.	Lubricating Devices.
	Turning up Mandrels.
	How to Waste Money.
	How to Save it.
Sept. 20.	Tells all about Line Shafts and Hangers.
	The Colts Arms Co's New Wrinkle in Shafts.
	An Aside to Prof. Sweet.
	"Chordal" as a Pilgrim.
	Is glad he didn't die last summer.

Business Specials.

Thirty cents a line for each insertion under this head.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Castings, Gear Wheels and other parts of models, at lower rates than can be made by hand. Tallman & McFadden, 607 Market St., Philadelphia.

Three second-hand Boring Mills for sale cheap. One of 9 feet swing and two of 5 feet swing. These mills must be sold, and can be bought very low. Write for description. Fuller Trump, Springfield, Ohio.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) C. F. H., Lynn, Mass., asks: Will you please tell me through your paper, the difference between Puppet-valve and Poppet-valve? Describe both and oblige a subscriber. A. The terms are precisely alike and are used to denote the same thing, viz., a Puppet-valve is on a round seat which moves vertically, and is guided to and from its seat by a central vertical stem, coincident with the axis of the seat. These valves are frequently operated by cams on a revolving shaft. The valve stems are guided above in sockets in the top plates of the valve chests, and by removing these plates the valves may be inspected or removed.

(2) G. S. B., New Milford, Conn., writes: Can you give me any rule for finding or working out a section of a circle, the section I wish to get being 15 ft. 3 in. long, and the whole circle being 256 feet in diameter. Please answer and oblige. A. We understand from the above that you wish to get the area of a segment of a circle, the length of the chord 15 ft. 3 in. and the radius 128 feet being given. Rule. Find the area of the sector having the same arc as the segment, then find the area of the triangle formed by the chord of the segment and the radii of the sector, and the difference of these areas will be the area required. Note.—Subtract the versed sine from the radius, multiply the remainder by one-half of the chord of the arc, and the product will be the area of the triangle. Should this not be plain enough you will find all that may be required in any good treatise on mensuration.

(3) A. P. H., West Philadelphia, Pa., writes: Will you please give me, a new reader, a few lines under the head of questions and answers? I have been in a machine shop for two years, and run a small engine of 8 H. P.—that is to learn to run one. 1. Can I get a license to run an engine about 12 H. P., also the place where I shall apply for such engine in Philadelphia? I am 23 years of age. Will you please tell me, through your paper, if the foregoing experience is enough to entitle me to a license, or, how much must a man know to get a license? 2. If you know of any good book on steam engines and boilers, please give me the title and I will get one. A. 1. In some places you could get a license by paying for it without having the requisite knowledge, but where the examinations are conducted on honest principles, a man is required to pass a thorough practical examination. We do not know what natural qualifications you may possess, therefore cannot answer you on this point. You are young, and should employ much of your time in study. The questions asked during the examination of an engineer pertain to the boiler principally, and can easily be answered by a practical man. 2. "The Catechism of the Steam Engine," by Stephen Roper, price, $2; and "Use and Abuse of Steam Boilers," by same author, price, $2, are good books for beginners and practical men.

(4) W.T. B., Conshohocken, Penn., writes: I put in a set of boilers. Where is the proper place for the feed water stop-valve, inside or outside of the check-valve? We have had an argument on this subject, and one says inside, *i.e.*, between the check-valve and the boiler, for the following reason: If anything happens to the check, close the stop-valve and it will enable you to repair the check without blowing off or stopping the boiler. The check is always working. A. The argument, in our opinion, is correct, having been thus decided by the best practical men. There are difficulties which appear either way; but with the plan suggested the only precaution necessary is to use a good packing in the stop-valve if of the globe pattern. We believe the best valve for this purpose to be a plug cock, composed wholly of brass or composition, as a composition plug in a cast-iron shell will invariably stick fast. With a cock of this kind there are fewer difficulties than with any other arrangement.

(5) E. H. R., Pittsfield, Mass., writes: In answer to the second question of A. H. G., Aug. 30th, you say: "No; the temperature of steam rises with the pressure, while the temperature of the water remains about the same, etc.;" which should be corrected, as when there is no fire under a boiler, the temperature of water and steam is about alike; but with a sharp fire, the temperature of the water lying against the fire surface is a little in excess of that of the steam. In a perfect vacuum water boils at 103° Fah., but a perfect vacuum can never be obtained at 2 lbs. above a perfect vacuum, 126° Fah. On the tops of high mountains travelers have found water to boil at so low a temperature that an egg could not be boiled in it. It boils at 212° atmospheric pressure at sea level; at 2 atmospheres, or 15 lbs. pressure by gauge, 252°; at 3 atmospheres, or 30 lbs. pressure by gauge, 276°; at 5 atmospheres, or 60 lbs. pressure by gauge, 311° It matters not whether steam or compressed air lies above the water to make the pressure.

(6) E. L. S., Baltimore, writes as follows: In your issue of August 4th I noticed a criticism on W. G.'s answer as to the method of ascertaining the amount of water in a given bulk of steam, at a stated pressure. I beg to state that W. G. is right, as far as the question was concerned. One cubic inch of water fully expanded, gives one cubic foot of steam, nearly at a pressure balancing the atmosphere or, 15 pounds. Now to find the amount of water in one cubic foot of steam at 80 pounds pressure, I divide 80 by 15 to ascertain the number of atmospheres, which gives for a quotient five and one-third (5 1-3); adding to this the one not indicated on the steam gauge, we have six and one-third atmospheres (6 1-3) or its equivalent, six and one-third cubic inches of water in one cubic foot of steam at eighty (80) pounds pressure.

MANUFACTURES.

Strikers are popular in no business but base ball.

Work has been commenced on the water works of London, South Ontario.

Another oil pipe line is to be constructed from Bradford, Pa., to Buffalo, N. Y.

The addition to the rolling mill of Potts Brothers' Iron Company, at Pottstown, Pa., will make it 140x40 feet.

C. E. Stevens has removed his emery-wheel factory from Easthampton, Mass., to Northampton, where he has enlarged accommodations.

At the Concord Axle Works at Fisherville, N.H., business continues very lively, so that extra hours of work are called for. Have not been able to keep up with orders since last March.

The Boston Machine Company are manufacturing for the Triumph Cotton Tie Company of New Orleans, 1000 tons of cotton tie buckles.

Parties have gone to Philadelphia to purchase machinery for a new cotton factory at Tuscaloosa, Alabama, and there is also talk of establishing a cotton factory at Shreveport, La.

The Florence machine company, of Northampton, are employing nearly double the largest working force which they have had for the past five years. They are running their works twelve hours a day.

An effort is being made to start a rolling mill at Nashville, Tenn. A company will be organized if a sufficient amount of stock subscriptions can be secured.

A committee from Toronto, Can., are in specting water works in our chief cities to study improvements.

L. J. Knowles is contemplating increasing the capacity of his warp mill at Warren, Mass. 50 per cent.

Pelgram & Myers, silk manufacturers, Paterson, N. J., are building an addition, 100 x 40, to their silk mill, and contemplate doubling their weaving capacity next year.

The Cleveland Steam Gauge Company have just received orders for 38 of their Watson forges and blowers, to go to Rio Janeiro, Brazil.

The Boott Co., at Lowell, Mass., is building an addition to its No. 5 mill, 48 feet deep, 20 front, four stories, to be devoted to weaving. It will be done in about three weeks. Two new steel tubular boilers, 5 feet diam., 17 feet long, are about to supplant two smaller ones on this corporation.

The laborers in Trumbull and Mahoning Counties', Ohio, coal regions have received the equivalent of an advance in wages by the operators lessening the price of house rent, cost of coal, oil and powder.

An Illinois farmer astonished Decatur by going into that place with a train of six wagons, laden with 375 bushels of barley, and drawn by a steam locomotive of his own invention.

Frick & Co., of Waynesboro, Franklin county, Pa., have just completed and shipped to a firm in Florida, the largest road engine yet made. Its total weight was thirteen tons. Each of the driving wheels weighed 2,700 pounds, and the smaller wheels 700 pounds each. The tire of the drivers is 16 inches broad. The engine has a capacity of 20 horse power, and will be used in sawing lumber and then hauling it to market.

Watertown, Mass., has finally decided, by a majority vote, to have water-works.

The Meridan, (Conn.) Manufacturing Company, are now erecting extensive works in Hamilton, P. O.

The Miller Brothers' Cutlery Company, of Meriden, Conn., contemplate the erection of a new and commodious building to facilitate their rapidly increasing business.

The Trinidad, (Col.) Water-Works are to have Isochronal, duplex, compound, non-condensing pumping engine and boilers complete. The capacity requirement is 2,000,000 gallons, 330 feet higher per 24 hours.

The foundry and boiler shop of the National Tube Works Company, at McKeesport, Pa., which were burned on the 29th ult, will at once be replaced by iron structures.

There are eleven Bessemer steel works in this country. The Vulcan Works, of St. Louis, were not represented at the late meeting in Philadelphia, and are still idle. Every rail mill in the country has orders for more than it can produce up to the end of the year, and many of them have taken orders for several months.

There is a New York gentleman at Geneva, N. Y., who desires to purchase the Tillman property. If the purchase is effected, a great manufactory will probably be built.

A Buffalo manufactory using considerable soft-fluid pig iron, having nearly exhausted a supply bought at $17.50 a ton, heard that the same iron was quoted at $20 a ton. Thinking that the buoyant condition of the market was somewhat exaggerated, the communication was not promptly answered. When it was, the best terms at which a large order would be filled were asked for. The reply was: "$24.50." Another letter was promptly forwarded, inquiring when the iron could be delivered. To this the following reply was received: "Not until next month, at $25; only two cars on hand. Price subject to change before your order is received."

Richards & Dole, the Taylor street machinists, says the *Springfield Republican*, have just finished for the Estey Organ Company, of Brattleboro, Vt, a novel machine for making automatic sheet music. The Esteys manufacture for the self-organist company a device which can be applied to any organ, through which, by the use of perforated paper over the keys, tunes can be played by the movement of the lever by one hand. The keys, instead of being struck by the fingers, are each depressed by one arm of a fork, the forks being worked by the lever, and striking the notes only as the perforations come along. The tune is thus played automatically, so far as working the keys is concerned, though the musician operates the stops, etc., as in common organs. Heretofore the sheets have been perforated by hand. This machine applies the principle of the Jacquard loom to punching the holes, which are about a third of an inch in diameter, in a roll of stout manilla paper, fluting the sheets and cutting them off. A horizontal beam which comes down upon the heads of the punches is raised and lowered by an eccentric. At one side of the machine is an endless chain of parallel bars which have projections upon them differently arranged for different tunes. As the chain revolves each projection strikes a pendulum, which shoves a horizontal rod above the head of the corresponding punch, and the descent of the beam then perforates the paper. This movement is much like a music-box in principle, only the parts which come together, instead of making sound punch holes in the roll of paper. A sheet of the perforated music paper is thus turned out with each revolution of the endless chain, or about one a minute. People having the organ attachment will buy these sheets, instead of sheet music, and the playing is, in part, automatic. A different chain, which punches the holes in different places, is, of course, used for each tune. The whole apparatus is very ingenious, and of entirely new design as applied to such use.

It is rumored that one of the boot factories at North Brookfield, Mass., which has been standing idle for some months past, is to be opened immediately, for the manufacture of an entirely different class of goods. If this shop is not used one will probably be erected, as there appears to be no doubt the new enterprise will be started at once.

The only work of importance accomplished this year by the Lowell Mass. Carpet Co., has been the erection of the weaving-shed for Brussels. Its size is 161 by 66 feet, 1 1-2 stories. The structure is about ready for the machinery, and the looms will probably be running by November 1st.

Plans have been prepared for the shops of the Indianapolis, Decatur & Springfield railroad at Indianapolis, which will cover an area of at least three acres, and will consist of one round-house 216 feet; car shops 80x240, with engine and boiler room between; blacksmith shops, 65x210 feet; boiler shops, 65x120 feet; paint shops, 132x132 feet; and office and main store room, 30x100 feet. They will all be substantially built of brick, with slate roofs, and will cost, including machinery, in the neighborhood of $80,000. Work will begin on them in a short time.

The Goulds Manufacturing Co., Seneca Falls, N. Y., employ in their factory about 200 men; are very busy, and running over time. The company has agencies in all the principal American cities, as well as London, England, and Bremen, Germany, and enjoy a large foreign trade.

S. N. & C. Russell, woolen manufacturers, are building a weave shop, at Pittsfield, which will be something of a novelty in factory architecture. It is to be 132 by 65 feet, and the roof will be of glass, providing better light and enabling imperfections to be detected more readily. When completed it will contain 80 broad looms taken from the present weave room to make way for more machinery.

The Sioux City (Iowa) *Journal* says:—Mr. John McMillan, roadmaster of the Sioux City and St. Paul Railroad, came here a short time since with his hand car rigged with canvas, sloop style. The experiment of sailing cars on railroads seems to be a new departure, and the success attending the trial was well marked. The car has been in use about two months, and gives perfect satisfaction, having made, with moderate breeze, upward of eighteen miles per hour.

The Wallingford, Conn., manufacturer who threatened to discharge all his workmen if they did not tell who whistled derisively at him, whenever he entered the works, was appeased by the discovery that a squeaking shaft was the offender.

David Knox, machinist, has just built an addition to the rear of his shop, on Oxford street, 15x36 feet, one story, for forging purposes. During the last few months Mr. Knox has employed 25 hands, and reports the present season the best in his line since he has been in business.—Lynn (Mass.) *Reporter*.

The Co-operative Stove Co., Cleveland, O., have sold this year 33,000 stoves, the entire product of their combined works, run to their full capacity. They have branches at Indianapolis, Chicago, St. Louis and Kansas City. Their Cleveland foundry is said to be the largest and finest in the world.

The Sydney *Herald* of July 17th, 1879, gives the following as the rates of wages in Australia:

"Iron Trade.—The following rates are paid by the hour, the men working eight hours a day, with two breaks in summer and one in winter. Iron-turners, 1s. to 1s. 5½d.; engine fitters, 11d. to 1s. 4d.; shipsmiths, 1s. to 1s. 6d.; blacksmiths, 1s. to 1s. 2d.; blacksmiths' strikers, 8d. to 9½d.; iron molders, 10d. to 1s. 3d.; pattern-makers, 1s. to 1s. 3d.; boiler-makers, 1s. to 1s. 4d; boiler-makers' assistants, 8d. to 9d.; general laborers in iron-works, 7½d. to 10d.; engine drivers, 9½d. to 10d.; furnace-men, 10d. to 1s. 2d.; dressers, 8½d. to 11d.; machine men in fitting shop, 10d. to 1s. 2d.; Country blacksmiths receive from £75 to £80 per annum, with rations or board."

Messrs. D. Cowan & Co. have decided to build an addition to their woolen mill, at Lewiston, which has already been largely extended the present year, provided they can purchase of the city the land adjoining their property on the north. The increased demand for their goods compel them to add more machinery.

The new twine-mill of Whittier & Son, Lowell, Mass., on or near Stackpole street, is finished, and about a quarter of the machinery is in place. The engine and boilers have been given a trial. Twenty-two spinning-frames and 18 Foss & Pevey cards will be soon running. The chimney of this mill is 70 feet high.

The Lawrence Mfg. Co., Lowell, Mass., are having ten steel tubular boilers built, by Richard Dobbins, Lowell, to be set with the Jarvis Furnace. The new Armory Mill, at Manchester, N.H., are having two steel tubular boilers manufactured by the same maker. These will also be set on the Jarvis System.

The Alden Emery Co. have been making some improvements at their works in South Walpole, Mass., putting in a new turbine water wheel, also having their boiler reset with the Jarvis Furnace.

A bag factory, to cost $40,000, is contemplated at Janesville, Wis.

A company has been organized in St. Louis for the manufacture of Medart's patent cold-rolled wrought iron or steel-rim pulleys, which, it is claimed, are superior to anything yet invented in this line.

Work has been commenced on the new rolling mill to be known as the Beaver Falls Iron Works. The plant has already been contracted for, and will include besides the furnaces and rolls a two-and-a-half-ton steam hammer.

At Cramps shipyards, Kensington, Philadelphia, 950 men are employed, and a great amount of work is being done.

The brass foundry and machine works, at Fort Wayne, Ind., have been much enlarged during the past year, and further improvements are still in progress. About 500 men are employed, and an average of 80 tons are melted, and 250 car wheels turned out per day. The works furnish several railroads with castings.

It is estimated that $1,000 is wasted every month in Bridgeport, Conn., in the purchase of lottery tickets, mainly by mill operatives.

Machinists' and Engineers' Supplies.

There is a fair degree of activity and buoyancy in prices. It is almost impossible to keep well-informed as to prices, for advances are taking place every day.

Girard Wrenches have advanced to 65, and 10% discount for Standard, and 70 and 10% for Agricultural.

While in Boston, lately, we noticed in the store of Goodnow & Wightman, a novelty in machinists' supplies. It is a hickory splint-broom, for sweeping shop floors, of the same shape as a common corn broom. The above firm had received 50 dozen of them. They are very durable.

Hart & Sloan, Newark, N. J., have recently bought the small machinery and tools owned formerly by the United States Watch Co., Marion, N. J., and are selling off such as they do not need to use in their own manufacturing business. This firm have recently improved their Hornum's Patent Horse Car Register, making it a knock-down argument against "knocking down" in fares. They began last year, the manufacture of the pedometer, which has become so fashionably prominent among amateur walkists. They make, also, large quantities of patent breech-loading gun implements, this being the height of the season in that line. They employ 50 to 75 hands, are full of orders, and working nights.

A. F. Prentice & Co., Worcester, Mass., notify us of an advance of $10 in the price of their new Screw-Cutting Foot Lathe, making the new price $150 each.

Peter A. Frasse & Co., 95 Fulton St., New York, inform us that they are crowded with orders from all parts of the country, for Hall's Patent Cutting Nippers, (described in our issue of Aug. 30th). Parties who ordered a sample lot to begin with are now calling for lots of several gross each. The tool cuts wire, or strips of metal, with wonderful ease, and is strong and durable. They send it by mail to any part of the United States, or Canada, for $1.25, and 6 cts. additional to prepay postage.

Situation Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 *words*), *at the nominal rate of twenty-five cents for each insertion.*

Wanted—Situation by practical belt maker; fourteen years experience in one place. Best references. WILLIAM E. PINKHAM, 56 Clymer Street, Brooklyn, E. D.

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A practical machinist and engineer of many years' experience as foreman and draughtsman, desires employment, or will take the agency of machinery of merit. Address "Foreman," office American Machinist, 96 Fulton St.

A first class mechanical draughtsman, thoroughly practical, well educated, a fine penman and colorist, desires a permanent situation in New York, or vicinity. Can be highly recommended. Address, Draughtsman, office of the American Machinist, 96 Fulton St., N. Y.

Steam and Mechanical Engineer desires a position as Salesman, Agent, or in any capacity where mechanical ability and business education will command a fair remuneration. Address, Ralph Campbell, 45½ Wilson street, Brooklyn, E. D.

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Every pair warranted.

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No. 3, " 4 "
No. 4, " 5 "
No. 5, " 6 "

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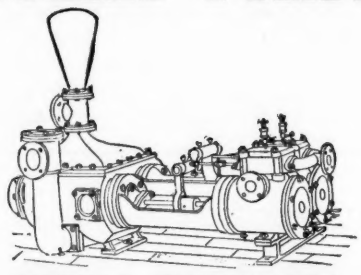

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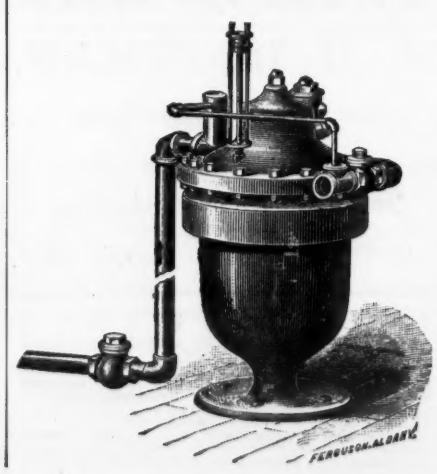

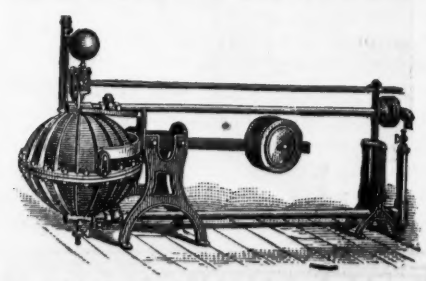

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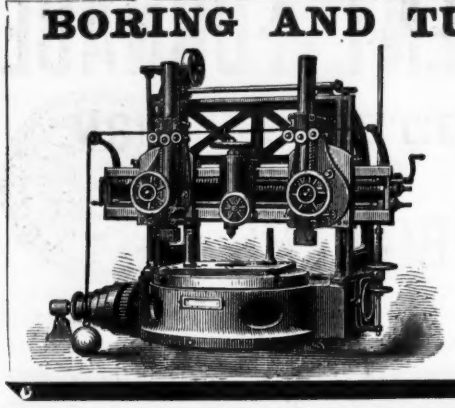

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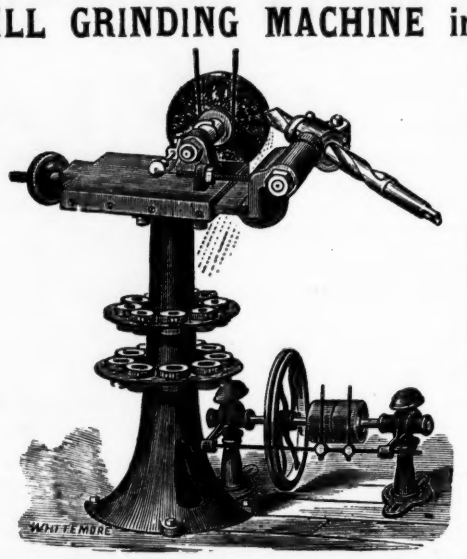

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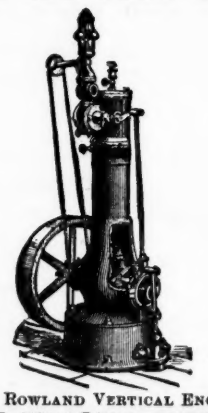

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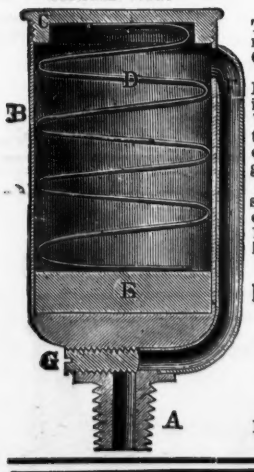

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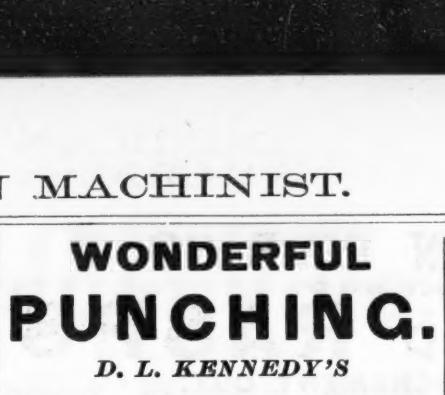

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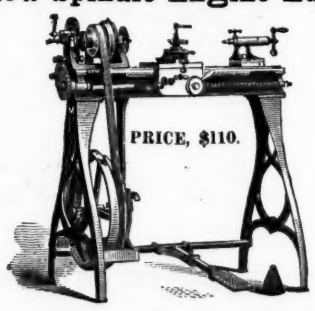

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Theron Skeel. December, 1877.

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Stephen Roper. March and April, 1878; June 28, July 12, 19, and August 2, 1879.

Standard Gauges and Tools for Accurate Measurements.
John J. Grant. May, 1878.

Strength of Steam Boilers.
John W. Hill. July, 1878.

The Properties of Water.
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Balancing Pulleys.
Geo. M. Chordal. August, 1878.

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Wm. Lee Church. September, 1878.

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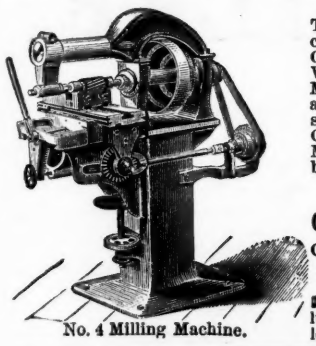

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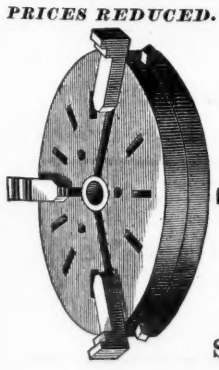

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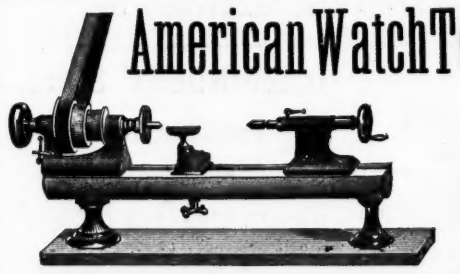

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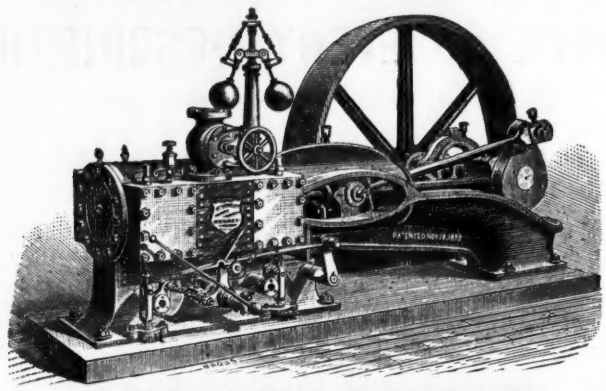

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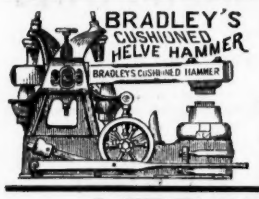

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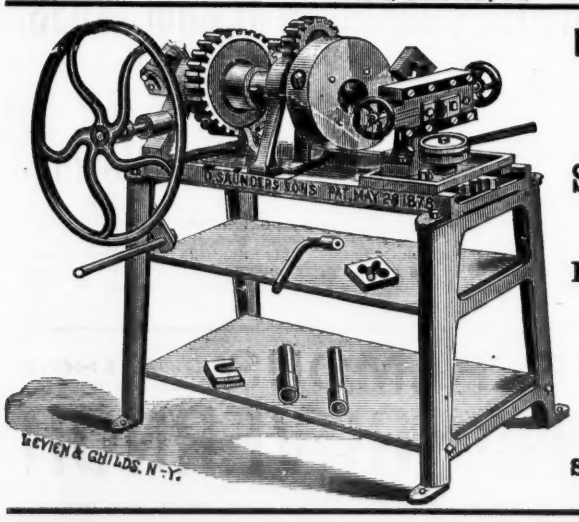

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[We desire to call particular attention to the above letter, as since it was received by us, Lieut. Mahan has confirmed his good opinion of our Engines therein expressed, by ordering two more of them.]

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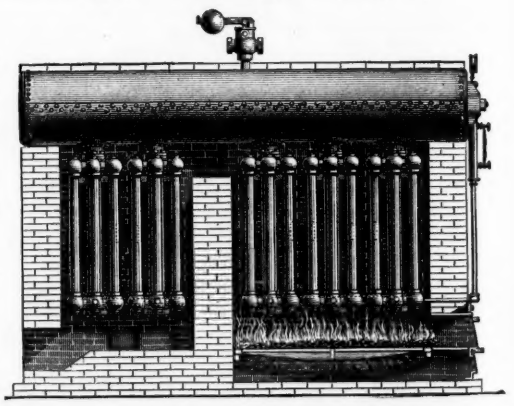

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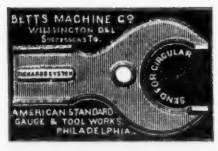

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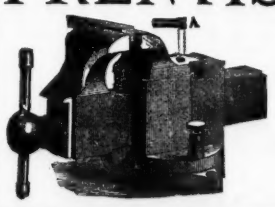

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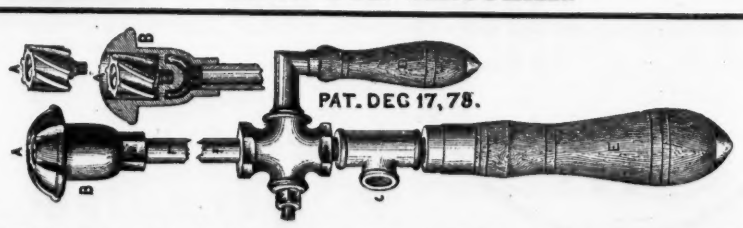

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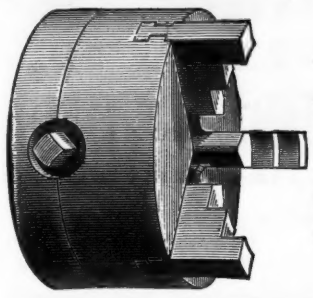

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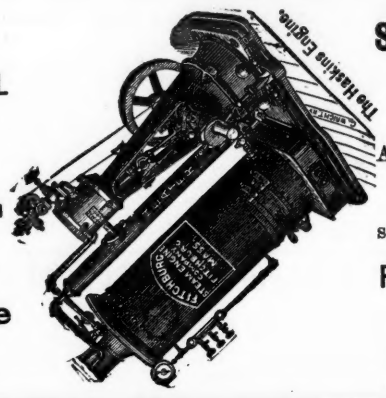

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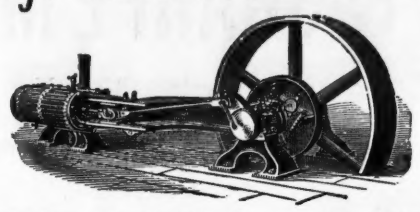

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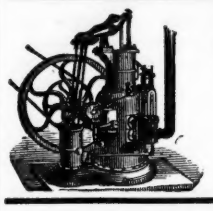

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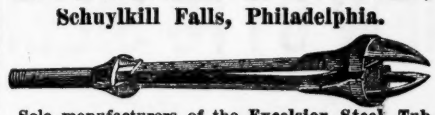

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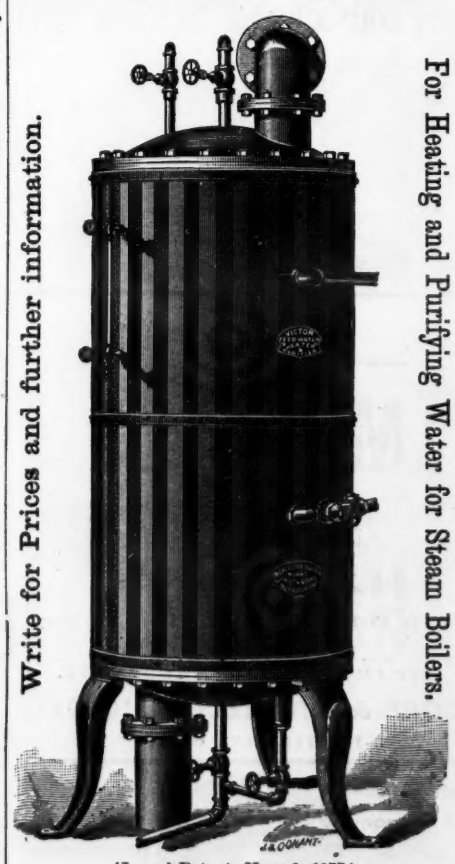

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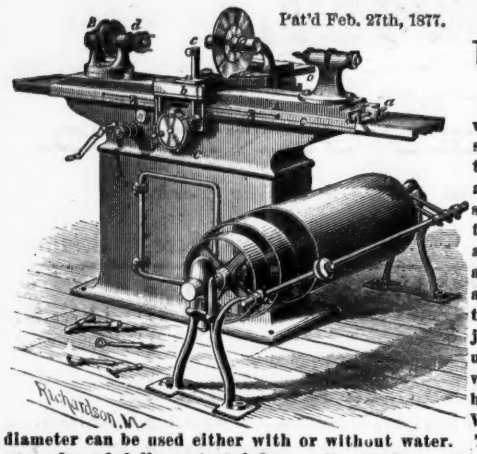

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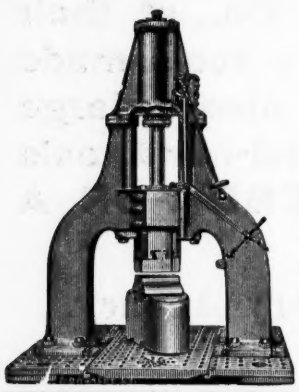

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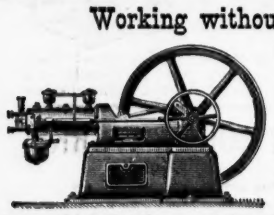

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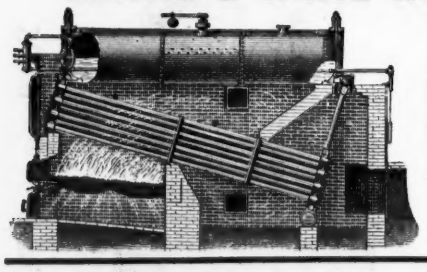

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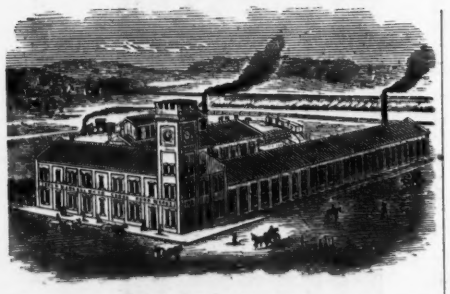

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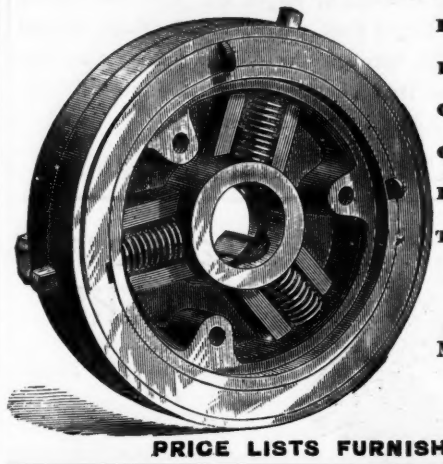

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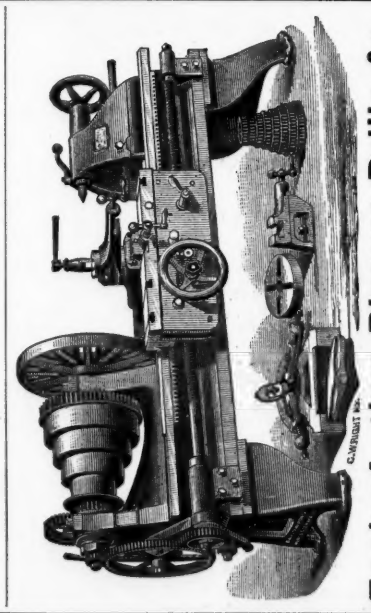

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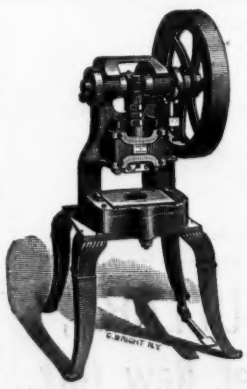

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